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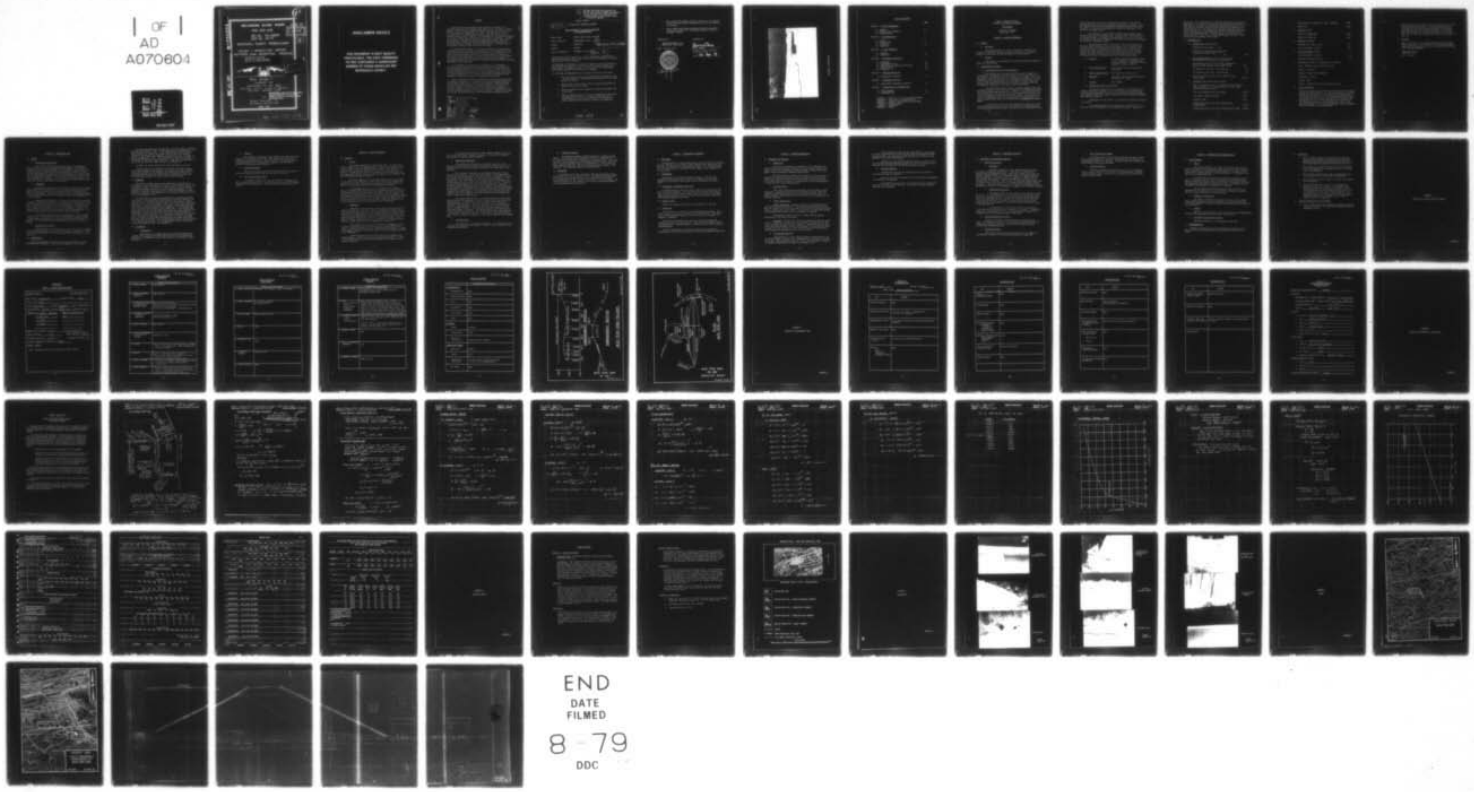

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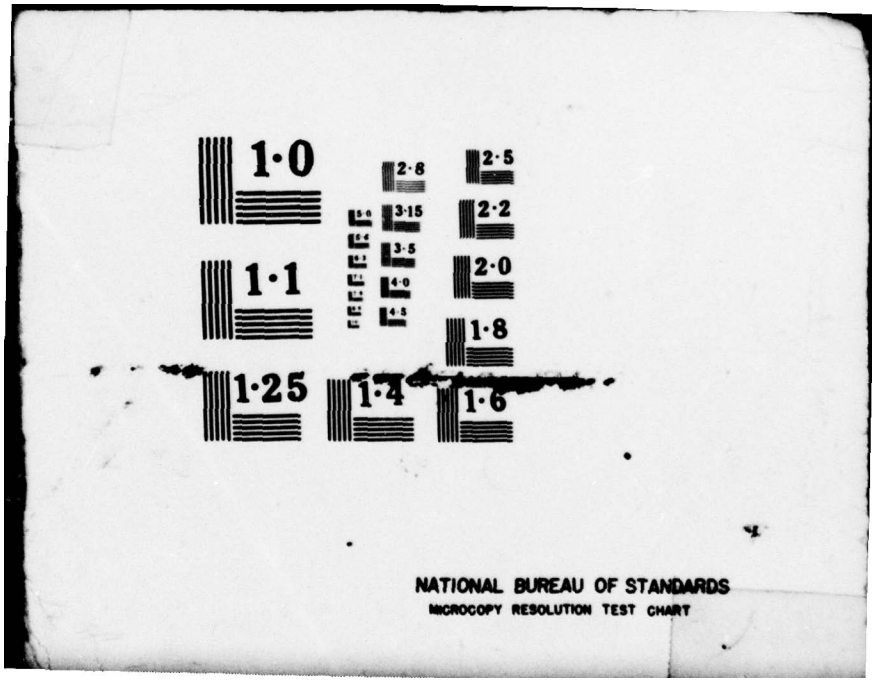
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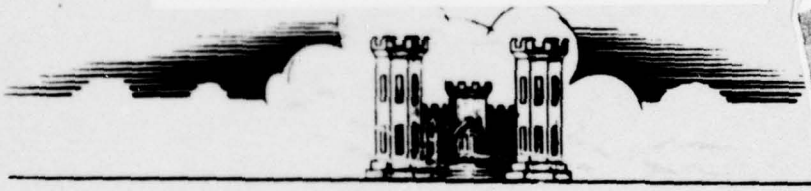
DELAWARE RIVER BASIN

MUD RUN DAM

NDI NO. PA-00690
DER NO. 54-27

SCHUYLKILL COUNTY, PENNSYLVANIA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



See page ii.

PREPARED FOR

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

BY

Berger Associates, Inc.
Harrisburg, Pennsylvania

APRIL 1979

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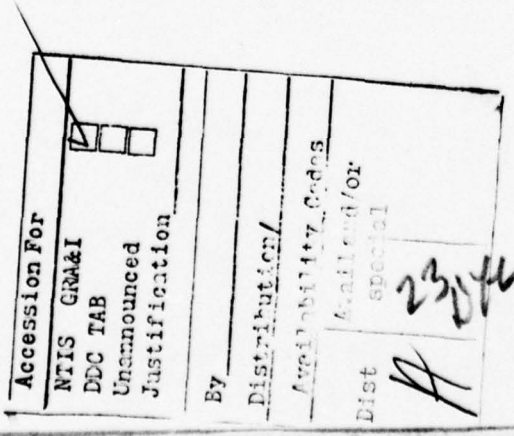
PREFACE

This report has been prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evoluntionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



(6) National Dam Inspection Program. Mud Run Dam (NDI Number PA-ØØ69Ø, DER Number 54-27), Delaware River Basin, Mud Run, Schuylkill County, Pennsylvania. Phase I Inspection Report.

PHASE I REPORT

(12) 73 p.

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITIONS
AND RECOMMENDATIONS

Name of Dam:	MUD RUN DAM, NDS NO. PA-00690
State & State No.	PENNSYLVANIA, 54-27
County:	SCHUYLKILL
Stream:	MUD RUN
Date of Inspection:	NOVEMBER 1, 1978

(15) DACW31-79-C-0042

(11) Apr 79

Based upon the visual inspection, historic performance, and the available engineering data and records, the dam and its appurtenant structures appear to be in fair condition.

The hydrologic and hydraulic calculations indicate that the spillway for this dam has the capacity for passing the full Probable Maximum Flood (PMF) without overtopping the dam. On the basis of this information, the spillway capacity is considered to be adequate.

The following recommendations are presented for action by the owner.

1. That all control valves be repaired and made operable and that a regular schedule of maintenance and operation of these items be put into action.

2. That the end of the spillway chute be repaired and protected against future erosive damage.

3. That the spillway outlet channel be cleared of all debris and obstructions.

4. That the seepage along the toe of the embankment be monitored and conditions reported on a regular schedule and that if significant increase in flow or evidence of turbidity are noted, remedial action be taken to relieve the condition.

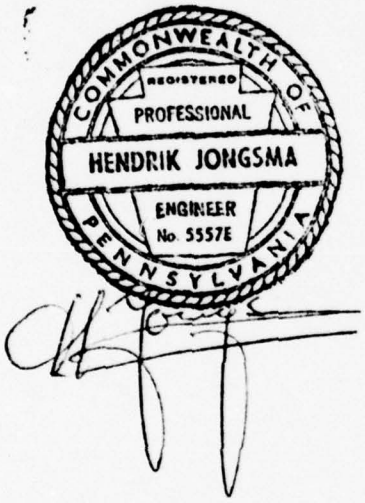
5. That a means for positive cutoff or closure of the upstream end of the blowoff pipe be developed for use in the event of an emergency.

6. That a formal surveillance program and downstream warning system be developed to be used during periods of heavy or prolonged rainfall.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

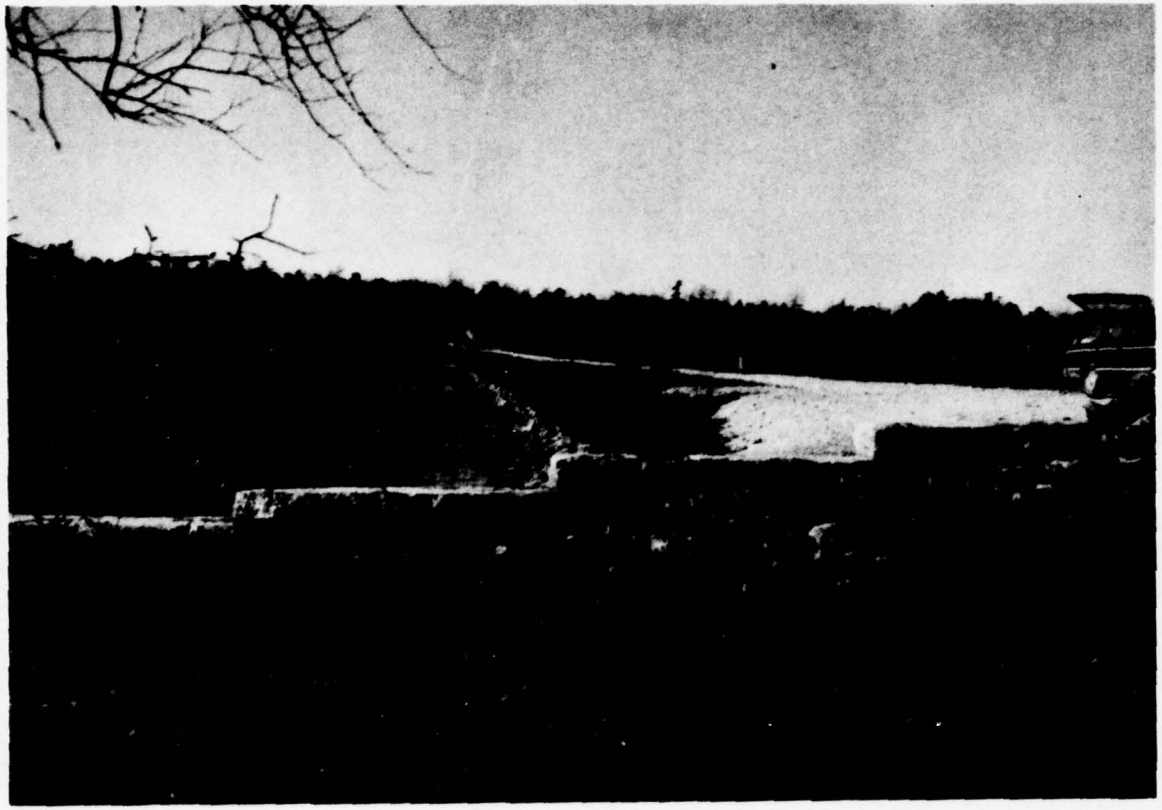
DATE: April 6, 1979



APPROVED BY:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

DATE 22 Apr 79



OVERVIEW - MUD RUN DAM

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MUD RUN DAM

NDS-ID NO. PA-00690
DER-ID NO. 54-27

SECTION I - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States.

B. Purpose

The purpose is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

The Mud Run Dam was designed and constructed in 1879 by the Philadelphia & Reading Coal and Iron Company. It was described in a 1914 report as an earthfill structure 1,124 feet in length. Very little information could be obtained as to the original construction. It was reported that the ground surface was well plowed to form a good bond with the fill and that the material, which was a mixture of clay and disintegrated conglomerate, was laid in layers and rolled.

The dam was practically rebuilt in 1903 by adding to the then existing structure. The centerline was moved 16 feet downstream and the dam crest was increased from 8 feet to 24 feet in width and raised five feet in elevation. The downstream slope was changed from 1-1/2H to 1V to 2H to 1V and both slopes were paved with riprap. The material used in the enlargement was clay and disintegrated conglomerate which was laid in layers from 6 inches to 8 inches and rolled ~~(Appendix F, Plate III)~~.

A concrete core wall five feet wide on top and ten feet wide at the bottom was carried through a pervious layer of underlying sand and gravel. The wall was placed at the toe of the old fill and its top

ABSTRACT

is ten feet below the crest of the wasteway (spillway). The present spillway and valve house on the spillway were built at this time. A 36-inch blowoff pipe was located beneath the wasteway about ten feet below its crest. The gate house contained the control for this pipe. This feature is no longer in use.

The spillway is constructed of masonry stone having a stone channel bottom and left abutment wall. The right side of the channel is the natural ground. The length of the spillway crest is 54.5 feet and the channel is 200 feet in length from the crest to its point of discharge to the natural downstream channel.

The operational blowoff consists of a 165 feet long 12-inch CIP which passes through the dam and into the first of two valve houses located at the toe of the downstream embankment slope. Flow from the first valve house is through one 10-inch supply line and one 12-inch blowoff line which leads to the second valve house about 20 feet downstream. The flow is again split in this valve house to a second 10-inch supply line and a continuation of the 12-inch blowoff pipe.

B. Location: New Castle Township, Schuylkill County
U.S.G.S. Quadrangle, Shenandoah, PA
Latitude 40°-46.2', Longitude 76°-13.8'
Appendix F, Plates I and II

C. Size Classification: Small (Height 39 feet, storage 852 acre-feet)

D. Hazard Classification: High (Refer to Section 3.1.E)

E. Ownership: Schuylkill County Municipal Authority
Pottsville, PA 17901

F. Purpose: Water Supply.

G. Design and Construction History

The dam was originally built in 1879 by the Philadelphia and Reading Coal and Iron Company. The records indicate that seepage was a continuous and progressive problem and that nothing was done to remedy this condition until 1903, some 24 years later, when the dam was enlarged and practically rebuilt.

Description of the features of the dam are presented in Section 1.2.A above.

The seepage problem has persisted over the entire life of the dam and is still a condition to be concerned with today. There was a

period after the reconstruction in 1903 that seepage was not reported. From 1923 on, the reference to seepage became more and more frequent. In 1938 there is reference to a swampy area downstream from the toe. In 1942 reference was first made to a pool of water about 100 feet downstream from the toe. The inspection of November 1978 observed the wet condition along most of the downstream toe of the embankment and the pool or pond mentioned above. Records indicate that weirs had been established and a daily flow of 51,800 gallons had been noted. There are no weirs in operation at this time.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

Computed for this report - 0.73

From report to Water Supply Commission regarding dam application - 0.7

Use 0.73

B. Discharge at Dam Site (cubic feet per second)
(See Appendix C for hydraulic calculations)

Maximum known flood, June 22, 1972, estimated on basis of nearby gaging station (peak inflow)	240
12" blowoff at pool Elev. 1,544 feet msl	8.9
12" blowoff at pool Elev. 1,512 feet msl	2.7
Spillway capacity at pool Elev. 1,548.4 feet msl (top of dam)	2,100

C. Elevation (feet above mean sea level)

Note: Elevations shown are referenced to USGS elevation from quadrangle map. Project datum is 6.5 feet lower. USGS 1544 = Project 1537.5).

Top of dam (lowest point from levels)	1,548.4
Top of dam - design elevation	1,550
Spillway crest	1,544
Blowoff and outlet pipe invert upstream end, approximately	1,510.8
Blowoff and outlet pipe invert downstream end, about	1,508.2

	Stream bottom at centerline of dam - estimate	1,509
	Normal pool	1,544

D. Reservoir (feet)

Length of maximum pool	2,800
Length of normal pool	2,400

E. Storage (acre-feet)

Spillway crest (Elev. 1,544)	622
Top of dam (Elev. 1,548.4)	852

F. Reservoir Surface (acres)

Top of dam (Elev. 1,548.4)	58
Spillway crest (Elev. 1,544)	48

G. Dam (Refer to Plate III, Appendix F for section)

Type: Earthfill with concrete core wall.

Length: 1,124 feet.

Height: 39 feet from streambed.

Top Width: 24 feet.

Zoning: None.

Cutoff: Concrete core wall (see Section 2.1.B).

H. Outlet Facilities

There is a single 175-foot-long, 12-inch cast iron pipe passing through the dam embankment. It is uncontrolled at the upstream end and has a ground-level gate valve at the downstream end. Just beyond the gate valve, the pipe divides into two ten-inch delivery pipes and one twelve-inch blowoff, all equipped with gate valves. The two ten-inch delivery pipes carry water to the distribution mains of nearby communities. None of the gate valves appear to be in working condition and the discharge end of the blowoff is partially buried.

Originally there was a high level 36-inch blowoff pipe passing under the spillway structure. The old masonry gate house still remains on a corner of the spillway but the present operating personnel do not know its purpose. It is filled with junk and there is no sign of the valve or the 36-inch pipe. The 36-inch pipe is reported to have had a capacity of 225 cfs.

I. Spillway

Type: The spillway is an uncontrolled broad crested, heavy masonry structure. In plan view, it has two sides forming a right angle which project out into the reservoir at the right end of the dam embankment.

J. Regulating Outlet

See 1.3.H above.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

A. Hydrology and Hydraulics

The files of the Pennsylvania Department of Environmental Resources did not contain any hydrologic or hydraulic calculations relative to the design of this dam. Records indicate that the dam was originally built in 1879 and then almost completely rebuilt in 1903. The spillway capacity in the early records was indicated as about 2,000 cfs. An additional discharge of 225 cfs was credited to a 36-inch pipe which ran under the spillway. This 36-inch pipe no longer exists. The only evidence of its existence, however, is the abandoned masonry valve house now sitting on the edge of the spillway.

B. Embankment

Design data, criteria or calculations in support of the embankment design are not available for review. An inspection report dated March 2, 1914, provides the most informative data of the dam and its historic development. This report indicates that the 1903 modifications to the original 1879 structure is reflected in the dam configuration as it stands today.

Regarding the embankment, the dam is described as an earthfill structure. The foundation support is provided by a 6-foot layer of clay over a 5-foot layer of sand and gravel on more clay. A concrete core wall is located at the toe of the initial embankment. The top of this wall is about 10 feet below the crest of the spillway. Its base is located below the layer of sand and gravel in the underlying clay. The wall is 5 feet wide at the top and 10 feet wide at its base.

Very little information could be obtained as to the original construction. It was reported that the ground surface was well plowed to form a good bond with the fill and that the material which was a mixture of clay and disintegrated conglomerate was laid in layers and rolled.

C. Appurtenant Structures

Design criteria or calculations are not in the files to support the size and configuration of the spillway or outlet facilities. Information on these features is found in the narrative reports which are in the files.

2.2 CONSTRUCTION

The most information recorded in the file is the March 2, 1914 memorandum which provides a brief historic summary of this project.

The dam was designed and constructed by the Philadelphia and Reading Coal and Iron Company in 1879. It was taken over by the Anthracite Water Company at a later date. It was reported that in its original condition, the dam leaked considerably but no efforts were made to control it until 1903. This covered a period of 24 years. In 1903, the dam was essentially rebuilt. The centerline was moved 16 feet downstream and the crest was raised five feet. A new core wall was built at the toe of the old slope (refer to Plate III, Appendix F).

The dam as it stands today reflects the modifications of 1903.

A 36-inch pipe was installed in the spillway area with a masonry valve house directly on the spillway. There are no records of the use of this pipe or when it was discontinued. Observations during this inspection did not reveal any valve control or evidence of this pipe. The valve house, however, is still in place on the spillway.

2.3 OPERATION

There are no formal records of the operation of this facility. Information from correspondence and reports in the PennDER files are the only source of data. The purpose of this reservoir is water supply. It is known that application for the use of flashboards was made in 1924. Subsequent inspection memorandum (1927) reported flashboards in place. There was no evidence of flashboards on the spillway at the time of this inspection (November, 1978).

The operation of the dam as determined from the available drawing and records is the withdrawal of water from the reservoir through a 12-inch pipe into a fish trap located in the first valve house. Flow is controlled by two 12-inch valves in series on this line, both inside the valve house. A 10-inch pipe which is the water supply main leaves the fish trap and carries the water to the community. A 12-inch pipe also leaves the fish trap through a third 12-inch valve. This 12-inch line enters another fish trap located in the second valve house about 20 feet downstream. One 10-inch pipe leaves this fish trap and is probably controlled further downstream. A 12-inch pipe is controlled at the fish trap. This pipe is identified as the blowoff for the dam. One other valve was observed outside and downstream from the second valve house. The exact size of this valve was not determined; however, it was observed to be leaking considerably. It is suspected that this is part of the blowoff line (Refer to Plate III, Appendix F).

2.4 EVALUATION

A. Availability

There was only a minimal amount of engineering information available for review of this dam, most of which is in the form of one drawing and correspondence rather than criteria, calculations or other such data.

B. Adequacy

The available information is not adequate for making detailed studies of the stability of the dam. The visual inspection, field measurements and observations, together with the file information are considered adequate for assessing the condition of the dam and the capacity of the spillway and reservoir.

C. Operating Records

There are no formal records of the operation of this dam for review and the owner did not indicate any special problems.

D. Post Construction Changes

As reported earlier, this dam was originally constructed in 1879 and was enlarged in 1903. The dam today reflects the 1903 changes. Flashboards were applied for in 1924 and used occasionally as late as 1927.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of this dam is fair. The crest has a width of about 24 feet of sand and gravel. This surface serves as an access roadway across the dam from left to right to the spillway. The upstream slope surface is cobbles and stones to the reservoir water surface. A light growth of weeds occur near the top of the slope. On the downstream side, the slope is stone and cobbles, top to bottom, with some weed growth through the cobbles.

Two valve houses are located just beyond the toe of the downstream slope of the embankment. These houses contain the controls for operation of the dam. The spillway, located at the right side of the dam is an uncontrolled broad crested heavy masonry structure.

The embankment appears to be in reasonably good condition, while the spillway and outlet channel are considered to be in only fair condition and in need of maintenance and repair. The end of the spillway has been washed away and a steep rock filled gully has formed. The rock appears to give sufficient protection, except that additional riprap should be placed on the left side. The poor condition applies also to the control valves in the two control houses. Refer to Appendix A for visual inspection check list and Appendix E for photographs.

B. Embankment

Inspection of the downstream slope surface did not reveal any symptoms of distress. The slope surface is composed of cobbles and is weed covered for the most part. There was no evidence of slope seepage observed. The upstream slope surface is also composed of cobbles and stone with some light weed growth near the top of the slope. The downstream slope was measured at 2.3H to 1V. The upstream slope is too short to measure an average slope angle; however, the available plans indicate a slope ratio of 2H to 1V (Appendix A, Plate A-I).

The profile survey along the crest of the embankment shows a variation in elevation up to 0.4 foot below the design elevation of 1543.5. Hydraulic calculations have considered this variation. Serious displacement, sloughs or settlements were not observed along any portion of the embankment.

Seepage water was observed along most of the length of the downstream toe. Flow of seepage water was barely detectible. A valve on the blowoff line is not properly closed and permits water to leak from the reservoir.

The seepage water appears to drain toward a ponded area to the left of the valve house. Refer to Plate Nos. AI and A-II in Appendix A for sketches of section, profile and plan.

C. Appurtenant Structures

The appurtenant structures for this dam include two valve houses, near the center of the dam, just below the downstream toe of the embankment and the spillway structure located at the right side of the embankment.

The spillway is described as an uncontrolled broad crested, heavy masonry structure. It has two sides forming a right angle which project out into the reservoir. The left side of the spillway is formed by a masonry wall which abuts the right end of the embankment. It is a stepped wall. The right side of the spillway channel is formed by the natural hillside slope. There is no structure on this side. The bottom or spillway bottom surface is also masonry construction. Grass and weeds are growing through the mortar joints and the entire structure is in poor condition. The outlet end of the spillway chute has deteriorated considerably as evidenced by the undermining of the chute and the debris laying in the outlet channel. The water level was one foot below the spillway crest at the time of the inspection and thus the spillway and outlet channel were completely dry.

The outlet from this dam is a 12-inch diameter cast iron pipe passing through the embankment to a valve house located just beyond the downstream toe. A second valve house is located about twenty feet downstream from the first. These structures are in fair condition and could use some maintenance. The valve controls are in poor condition and are in need of repair. The stem yokes are rusted through in some places and should be replaced. Each house contains one 12-inch and one 10-inch valve and a fish trap. The 10-inch valves control discharge to a 10-inch water supply line and the 12-inch valves control the blowoff pipe. Refer to Plate III, Appendix F, for plan of pipe and valve arrangement.

D. Reservoir Area

The reservoir is surrounded by forests. All slopes appear to be stable and erosion was not noticed. There is also no evidence of any sedimentation problems.

E. Downstream Channel

The downstream channel from Mud Run Dam is a natural stream channel. The channel below the spillway outlet was completely dry at the time of this inspection. Mud Run is a tributary to Mill Creek. The run joins the creek about two miles downstream from the dam. From that point, the major inhabited area is the Borough of St. Clair about two miles further downstream. Mill Creek flows through the center of this community. The downstream hazard is considered high.

3.2 EVALUATION

The results of the visual inspection highlight the need for maintenance and repair of all control valves. The embankment slopes appear to be stable with seepage limited to the downstream toe and beyond. The downstream end of the spillway chute is also in need of repair. The overall evaluation of the condition of the dam is fair owing primarily to the maintenance and repair needs.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The Mud Run Dam is a water supply source for the Borough of Gilberton. The poor condition of the control valves indicates that these facilities have not been operated for a long period of time. It is understood that the flow from the dam is controlled by user demand at the consumer end of the system.

4.2 MAINTENANCE

The results of the visual inspection indicate a need for some regular maintenance program for this dam. In addition to the poor condition of the valves, the spillway outlet and channel need attention.

4.3 MAINTENANCE OF OPERATING FACILITIES

As indicated above, the valves which control the outflow from this dam are in poor condition. The stem yokes will probably need replacement as they are nearly rusted through. One of the valves is leaking, permitting considerable flow in the outlet ditch below the valve house. This condition should be corrected.

4.4 WARNING SYSTEM

There is no formal warning system in operation for this dam.

4.5 EVALUATION

This facility is in need of regular maintenance and repair. The major concern is the poor condition of the control valves. They should be put into operational condition in order to be able to respond to emergency situations.

The end of the spillway chute should be protected to prevent continued erosion of the masonry base. Also the outlet channel should be maintained in a cleared condition to permit the free flow of spillway discharge water.

A formal surveillance and downstream warning system should be established to be used during periods of heavy or prolonged precipitation.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

Very little information was available on the hydrologic and hydraulic design of the dam. There were no area-capacity curves, frequency curves, unit hydrographs, design storm data, design flood hydrographs, flood routings nor spillway rating curves.

The dam was built in 1879 and was raised five feet in 1903. A 1914 report listed the spillway capacity as 2,000 cfs and 225 cfs was added as the capacity of the 36-inch blowoff pipe under the spillway. It was noted that the reservoir is seldom filled as the storage capacity is large for such a small drainage area.

B. Experience Data

Very little information was available from the owner's representatives. Calculations based on the USGS gaging station record for Ringtown, Pennsylvania, indicate that the flood of June 22, 1972 probably produced a peak inflow of about 240 cfs or about 10 percent of the spillway capacity.

C. Visual Observations

Outlet Facilities. Apparently little or no maintenance work is done on the outlet facilities. Operating personnel have no need to make any changes in the valve settings as flow in the two 10-inch delivery pipes is controlled by user demand. The reservoir is seldom full because of user demand and because of the large amount of leakage.

Observations indicate there is a strong need for general maintenance of the outlet facilities.

Spillway. For the first thirty feet downstream from the centerline of the dam, the spillway chute is lined with carefully fitted flat rocks in apparently their original condition. Downstream from the above reach, the chute steepens and the lining changes to loose unfitted rocks. It could be, that this area of loose rocks will work its way upstream and eventually cut through the crest of the spillway.

D. Overtopping Potential

Mud Run Dam has a total storage capacity of 852 acre-feet and an overall height of 39 feet above streambed, both referenced to the top of the dam. These dimensions indicate a size classification of "Small". The hazard classification is "High" (see Section 3.1.E).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is from 1/2 the Probable Maximum Flood (PMF) to the full PMF. For this dam, the PMF peak inflow is 1,843 cfs (see Appendix C for inflow computations).

Comparison of the estimated PMF peak inflow of 1,843 cfs with the estimated spillway discharge capacity of 2,100 cfs indicates that a potential for overtopping of the Mud Run Dam does not exist.

E. Spillway Adequacy

Calculations show that the spillway carries the full PMF with about one foot of freeboard.

Since the spillway can handle the full PMF without overtopping, it is judged to be adequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

The visual inspection of the embankment did not detect any signs of embankment instability. There were no indications of seepage from the embankment slopes. There were, however, wet areas all along the downstream toe of the embankment with free standing water at several locations. The slope surface is composed of cobbles and sand with moderate weed growth. Sloughs, depressions or irregular slope surfaces were not observed. The crest of the embankment showed deviations of from 0.4 feet to 0.1 feet below the design surface elevation across its length. The upstream slope is 2H to 1V and the downstream slope was measured at 2.3H to 1V. The embankment is judged to be in stable condition.

2. Appurtenant Structures

The control valves for the outlet at this dam are in need of repair. It is understood that there is little need to operate these valves, as the supply of water is controlled by user demand downstream. Their poor condition does not influence the stability of the structure but reduces the ability to respond to emergency conditions when the valves may need to be operated. There is no control of the outlet pipe at the upstream end.

The deteriorated condition at the end of the spillway outlet chute is not critical to the stability of the dam. If allowed to continue to deteriorate, however, it can have negative impact on the performance of the dam during periods of heavy flow.

B. Design and Construction Data

There is no design or construction data available in the files. The judgement relative to the stability of these facilities is based upon the visual appearance, historic correspondence and post construction inspection reports.

C. Operating Records

There are no formal operation records on file to judge the performance or behavior of this dam during periods of high flow.

D. Post Construction Changes

The modifications to the original 1879 dam were made in 1903. These changes enlarged the structure considerably and on the basis of the drawings improved its stability. The crest width was increased and raised and the slopes were flattened.

E. Seismic Stability

This dam is located in Seismic Zone 1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection, the review of available data and the historic records of this dam indicate that the dam is in fair condition. This classification of condition is based mainly on the need for maintenance of the spillway and the operating facilities. The safety of the dam is not seriously affected.

The results of the hydrologic and hydraulic analyses for the dam, in accordance with the Corps of Engineers' evaluation guidelines, indicates that the spillway capacity and reservoir storage are sufficient for passing the PMF without overtopping the dam. On the basis of this information the spillway is considered to be adequate.

The continuing and persistent seepage along the toe of the embankment is of concern since it apparently is now taken for granted and is no longer monitored or closely observed.

B. Adequacy of Information

The historic information available for review and the information gathered during the field inspection of the dam are considered sufficiently adequate for making a reasonable assessment of the condition of this facility.

C. Urgency

Immediate action should be taken to carry out the recommendations presented for maintenance and operation of this facility.

D. Necessity for Additional Studies

Additional studies are not indicated at this time.

7.2 RECOMMENDATIONS

In order to assure the continued satisfactory operation of this dam, the following recommendations are presented for action by the owner:

A. Facilities

1. That all control valves for this dam be put into good repair and made operable and that a regular program of maintenance and service be developed and put into action. The valves should be operated at least once each year.

2. That a means for positive cutoff or control be developed for the upstream end of the blowoff pipe for use in the event of an emergency.

3. That the end of the spillway chute be repaired and protected against further erosion and deterioration.

4. That the spillway outlet channel be cleared of all debris and obstructions.

5. That the seepage along the toe of the embankment be monitored on a regular schedule. Volume and clarity shall be recorded for comparison and analysis. Such records should include the elevation of the water level in the reservoir at the time of the observation. If significant increase in flow is noted or if the seepage discharge becomes turbid, immediate steps should be taken to correct the condition.

B. Operation and Maintenance Procedures

1. That a formal surveillance program and downstream warning system be developed to be used during periods of heavy or prolonged rainfall.

APPENDIX A

CHECKLIST OF VISUAL INSPECTION REPORT

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 54-27 NDI NO. PA-00 690

NAME OF DAM Mud Run Dam HAZARD CATEGORY High

TYPE OF DAM Earth

LOCATION New Castle TOWNSHIP Schuylkill COUNTY, PENNSYLVANIA

INSPECTION DATE 11/1/78 WEATHER Sunny, Breezy, Cool TEMPERATURE 60°

INSPECTORS: R. Houseal (Recorder) OWNER'S REPRESENTATIVE(s):

A. Bartlett None

R. Steacy

D. Remmel

NORMAL POOL ELEVATION: 1537.5 AT TIME OF INSPECTION: 1' below spillway elevation

BREAST ELEVATION: 1543.5 POOL ELEVATION: 1536.5

SPILLWAY ELEVATION: 1537.5 TAILWATER ELEVATION: --

MAXIMUM RECORDED POOL ELEVATION: Unknown

GENERAL COMMENTS:

Note: Elevations above are referenced to project datum.

NDI NO. PA-00 690

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None evident.
B. UNUSUAL MOVEMENT BEYOND TOE	None evident.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	Slopes relatively uniform. Downstream low brush growing through rock cover. No serious erosion evident. Soil on top of embankment - sand and gravel.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	Horizontal alignment - good. Vertical variation - 0.4'.
E. RIPRAP FAILURES	None evident
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Abutments - good.
G. SEEPAGE	Seepage along most of downstream toe of embankment. Very slight flow. Water standing and virtually stagnet.
H. DRAINS	Device in line with outlet structure. Tubes on both sides of embankment at the toe adjacent to outlet structure.
J. GAGES & RECORDER	This instrument installed by building contractor to monitor seismic response at dam to blasting at nearby shopping mall construction.
K. COVER (GROWTH)	Upstream cobbles and stone below light weed growth. Downstream cobbles and stone top to bottom - weed growth on slope. Top sand and gravel roadway - width 24'±

NDI NO. PA-00 690

VISUAL INSPECTION
OUTLET WORKS

	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	Submerged - not visible - refer to drawings.
B. OUTLET STRUCTURE	12" pipe water supply. 12" blowoff valve.
C. OUTLET CHANNEL	Grass, brush and trees.
D. GATES	None.
E. EMERGENCY GATE	None.
F. OPERATION & CONTROL	None available.
G. BRIDGE (ACCESS)	None.

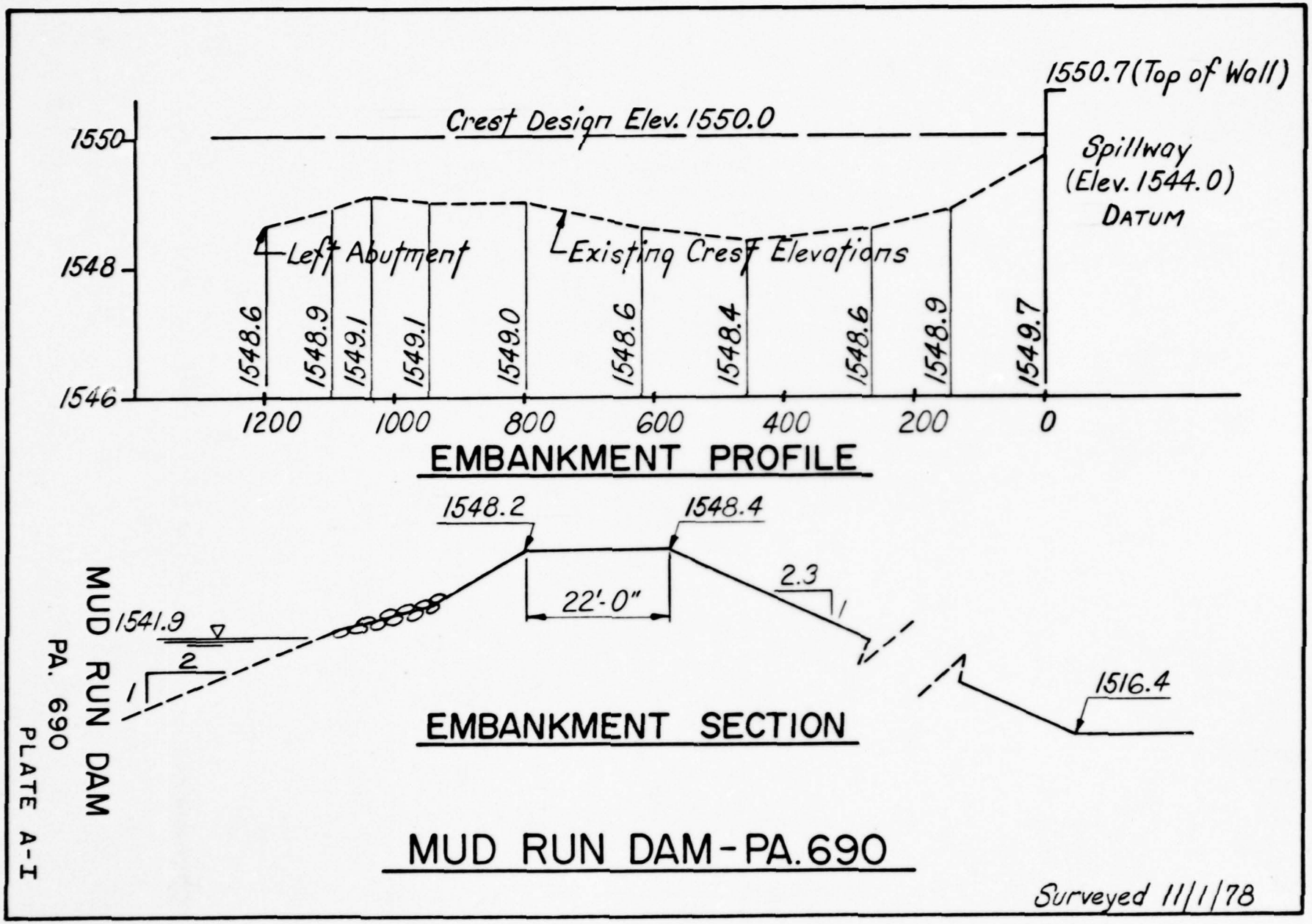
NDI NO. PA-00 690

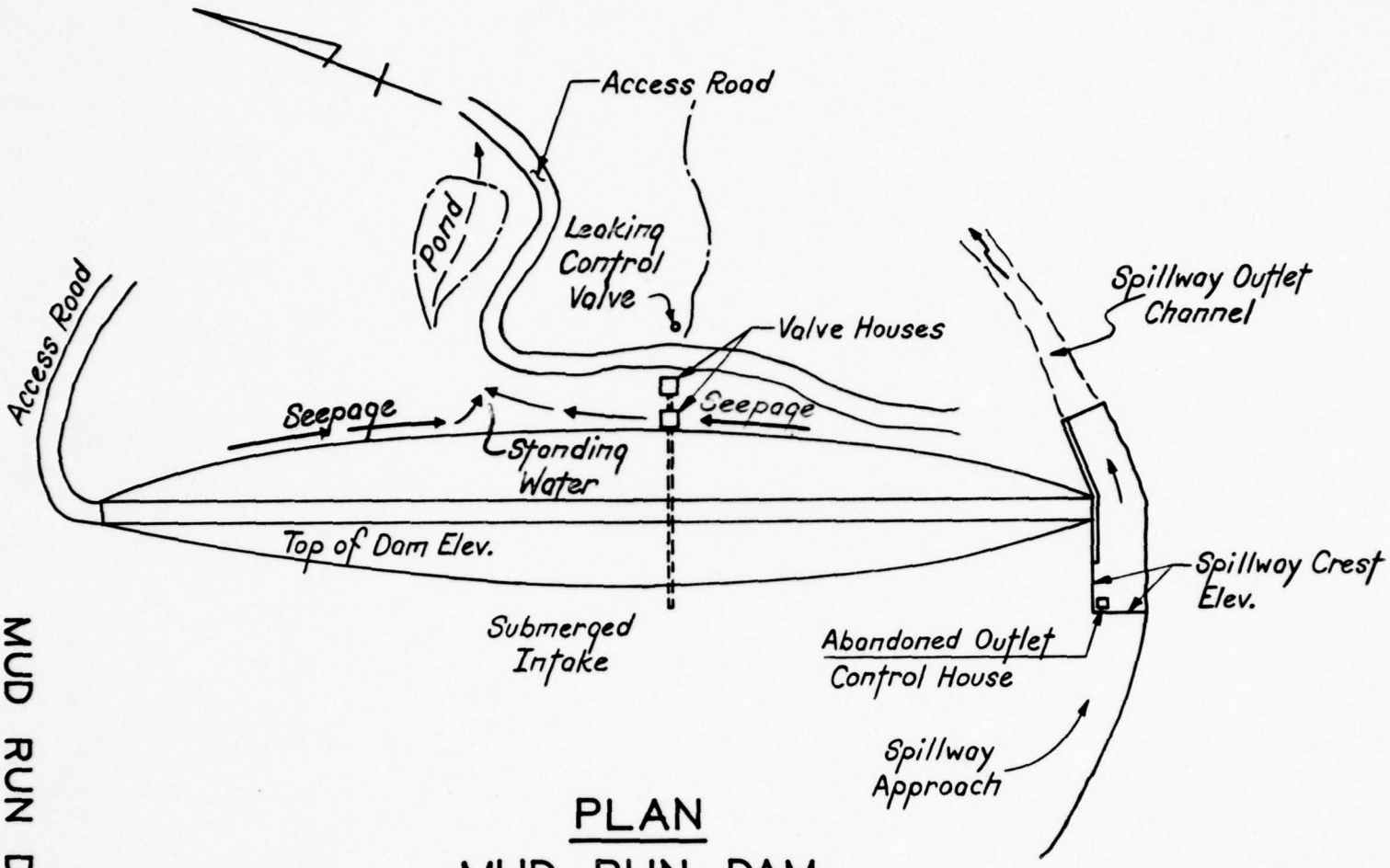
VISUAL INSPECTION
SPILLWAY

	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	Sand bottom - 3 to 5-inch rocks. Old Valve House at top of crest (no valve) Rectangular shaped weir.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Broad crested weir gradual slope. Mortar is cracked away exposing about half of the rocks (rough, crevaces) from upper end of abutment on down. The crest is covered (except for a 6' wide channel of rocks in the middle) with topsoil and grass, small bushes have been cut down. Spillway chute lined with 2' rocks, 30° slope left abutment stone masonry, stable (good condition) no right
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	abutment, right side of spillway embankment covered with small trees and brush - 20° slope. No flow over the spillway. 6" to 18" riprap. Steep banks, narrow trees in channel - seepage into channel about 150 feet downstream of spillway toe.
D. BRIDGE & PIERS	None.
E. GATES & OPERATION EQUIPMENT	None.
F. CONTROL & HISTORY	Refer to files.

VISUAL INSPECTION

	OBSERVATIONS AND REMARKS
INSTRUMENTATION Monumentation	None.
Observation Wells	None.
Weirs	None.
Piezometers	None.
Staff Gauge	None.
Other	None.
RESERVOIR Slopes	Forested.
Sedimentation	Clean
Watershed Description	Mountain Terrain Forests.
DOWNSTREAM CHANNEL Condition	Wooded
Slopes	Flat
Approximate Population	St. Clair about 4 miles downstream. Channel runs through Borough.
No. Homes	Many.


1550.7 (Top of Wall)
Crest Design Elev. 1550.0
1550
1548
1546
Spillway
(Elev. 1544.0)
DATUM
Left Abutment
Existing Crest Elevations
1548.6
1548.9
1549.1
1549.1
1549.0
1548.6
1548.4
1548.6
1548.9
1549.7
1200
1000
800
600
400
200
0
EMBANKMENT PROFILE
1548.2
1548.4
2.3
1
22'-0"
1541.9
2
1
1516.4
EMBANKMENT SECTION
MUD RUN DAM
PA. 690
PLATE A-I
MUD RUN DAM - PA. 690
Surveyed 11/1/78



PLAN

MUD RUN DAM

Surveyed 11/1/78

MUD RUN DAM
PA. 690
INSPECTION SURVEY
PLATE A-II

APPENDIX B

CHECKLIST OF ENGINEERING DATA

CHECK LIST
ENGINEERING DATA

PA DER # 54-27 NDI NO. PA-00 690

NAME OF DAM Mud Run Reservoir

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle - Shenandoah, PA. See Plate II, Appendix F
CONSTRUCTION HISTORY	Correspondence and Post Construction Inspection Reports.
GENERAL PLAN OF DAM	None.
TYPICAL SECTIONS OF DAM	One section of 1903 Modification.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	None.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	None.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	None.
POST CONSTRUCTION SURVEYS OF DAM	Inspection Reports.
BORROW SOURCES	None.

NDI NO. PA-00 690

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	1903 Enlargement 1924 Addition of flashboards.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	Post Construction Inspection Reports.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	None.
MAINTENANCE & OPERATION RECORDS	None.
SPILLWAY PLAN, SECTIONS AND DETAILS	None.

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	General plan only.
CONSTRUCTION RECORDS	None.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	Seepage condition reported since construction in 1879.
MISCELLANEOUS	

NDI NO. PA-00 690

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Woodland.

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev.1,544 622 Acre-Feet

TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev. 1548.4 852 Acre-Feet

MAXIMUM DESIGN POOL: Elev. 1548.4

TOP DAM: (low point) Elev. 1548.4

SPILLWAY:

a. Elevation (U.S.G.S. Elevation) 1544.0

b. Type Broad crested weir.

c. Width 55 feet.

d. Length 110 feet chute.

e. Location Spillover

f. Number and Type of Gates None.

OUTLET WORKS:

a. Type 12-inch C.I. Pipe.

b. Location Near center of embankment.

c. Entrance inverts 1509.8

d. Exit inverts 1508±

e. Emergency drawdown facilities 12-inch C.I. Pipe.

HYDROMETEOROLOGICAL GAGES:

a. Type None.

b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: Unknown.

APPENDIX C

HYDROLOGY AND HYDRAULIC CALCULATIONS

SUMMARY DESCRIPTION
OF
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam, and (2) the capability to estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge, time of the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

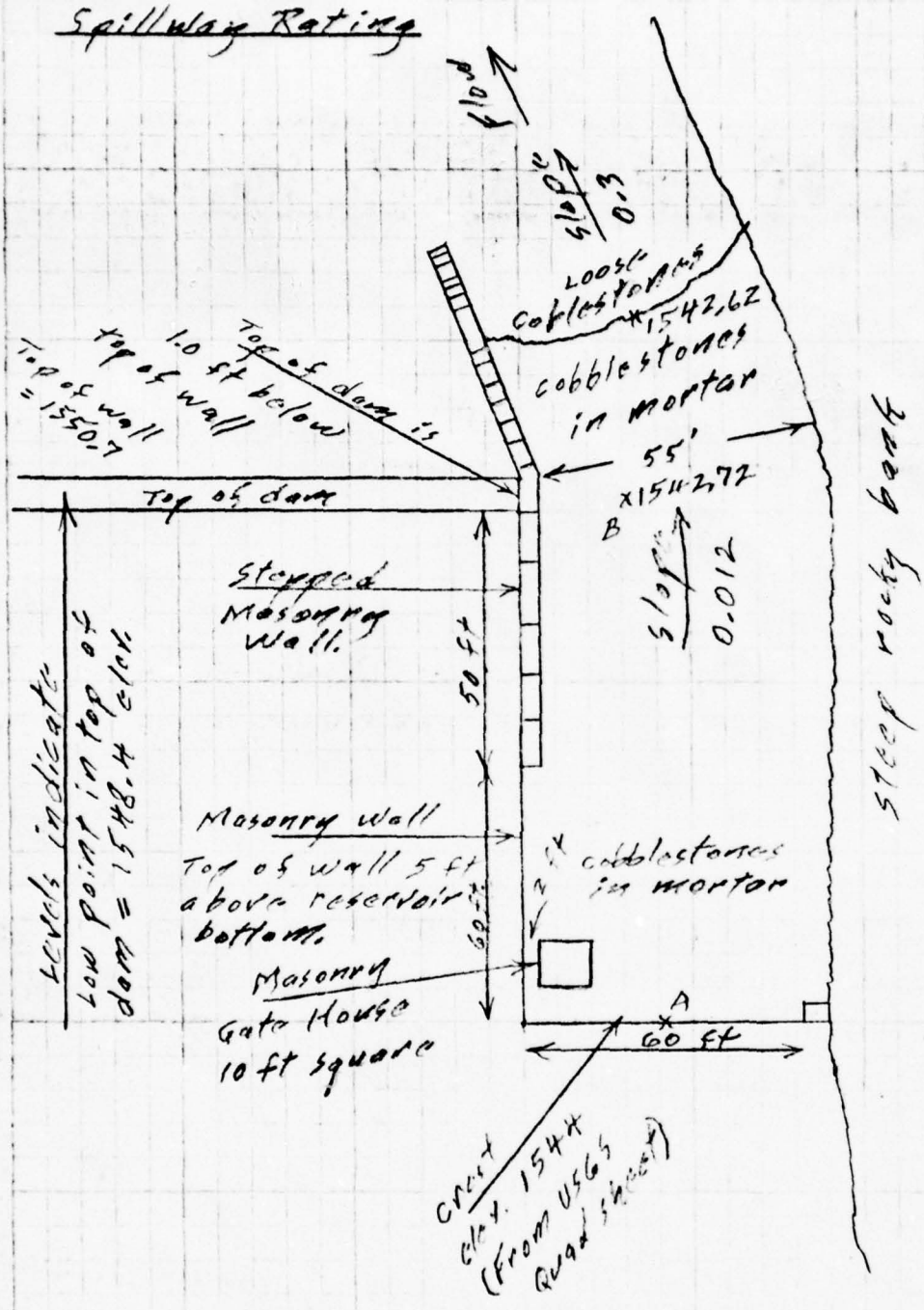
For detailed information regarding this program refer to the Users Manual for the Flood Hydrograph Package (HEC-1) Dam Safety Version prepared by the Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California.

PROJECT [illegible] SHEET NO. 1 OF 1

SUBJECT Mud Run Reservoir Dam ID No. 690

COMPUTED BY RES DATE 11-7-78 CHECKED BY JJPJr 11-22-78

Spillway Rating



Compute spillway capacity as broad crested weir with head H = Low point in dam minus spillway crest elev. or 1548.4 − 1544.0 = 4.4 ft. and L = Chute width at ℄ of dam = 55 ft.

$$Q = CL(H)^{3/2} = 3.10 \times 55 \times (4.4)^{3/2}$$

$$= 1{,}570 \text{ cfs}$$

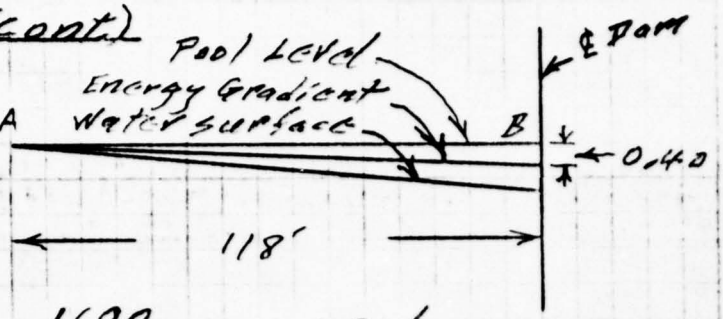
See sheet 2 for source of "C" = 3.10

Now adjust for energy loss Pt. A to Pt. B.

SUBJECT Mud Run Reservoir Dam - ID No. 690

COMPUTED BY RES DATE 11-13-78 CHECKED BY JJPJr 11-22-78

Spillway Rating (cont.)



Est.

$Q = 1{,}600$ cfs

$a = LD = 55 \times 4.4 = 242$

$r = \frac{242}{63.8} = 3.79$

$n = 0.03$, $V = \frac{Q}{a} = \frac{1600}{242} = 6.61$ ft/sec

$V = \frac{1.486}{n} \times r^{2/3} \times S^{1/2}$

$6.61 = \frac{1.486}{0.03} \times (3.79)^{2/3} \times S^{1/2}$

$6.61 = 120\, S^{1/2}$, $S^{1/2} = \frac{6.61}{120} = 0.0551$

$S = 0.00303$

$Fall = 0.00303 \times 118 = 0.36$ (friction)

Recompute spillway capacity as broad-crested weir at ℄ of dam.

$Q = CLH^{3/2} = 3.10 \times 55 \times (1548.4 - 0.36 - 1542.72)^{3/2}$

$= 2{,}092$ cfs

Use 2,100 cfs

Source of "C" = 3.10 Page 5-24 of "Brater and King" gives the maximum "C" value for a broad crested weir flowing at critical depth as 3.087. In view of the approximations in this situation, this was rounded to 3.10.

SUBJECT Mud Run Reservoir - ID No. 690

COMPUTED BY RES DATE 11-10-78 CHECKED BY JJPJr 11-22-78

Maximum Known Flood

USGS gaging station at Ringtown
Drainage area 1.77 sq. mi.
Maximum flood 1959-1978 = 487 cfs
6-22-72

Mud Run Resv. drainage area 0.7 sq. mi.

$$\left(\frac{0.73}{1.77}\right)^{0.8} \times 487 = 240 \text{ cfs}$$

Blowoff capacity

There is a 165 ft long 12-inch CIP passing thru dam. After first valve, this pipe splits into two 10-inch delivery pipes and one 12-inch blowoff pipe.

invert upstr end of pipe 1510.8
invert dnstr end of pipe 1508.2

Pool at 1544 $h = 1544 - 1508.7 = 35.3$

$$h = 35.3 = K\frac{V^2}{2g} + 2.87 n^2 \frac{165 V^2}{d^{4/3}}$$

$$= 0.5\frac{V^2}{64.3} + 2.87(0.015)^2 \frac{165 V^2}{(0.5)^{1.33}}$$

$$= V^2\left(0.00778 + \frac{0.1065}{0.3969}\right)$$

$$= V^2 \times 0.2761$$

$$V = 11.3 \text{ ft/sec}$$

$$Q = VA = 11.3 \times \pi (0.5)^2 = 8.87 \text{ cfs}$$

Pool at 1512 $h = 1512 - 1508.7 = 3.3$

$$V^2 = \frac{3.3}{0.2761} = 11.95 \qquad V = 3.457$$

$$Q = VA = 3.457 \times \pi (0.5)^2 = 2.7 \text{ cfs}$$

BY D.I.K. DATE 11/6/74 **BERGER ASSOCIATES** SHEET NO. 4 OF 12
CHKD. BY R.I.S. DATE 2/27/79 PROJECT D8490
SUBJECT MUD RUN RESERVOIR DAM

Spillway Rating (cont.)

AT ELEVATION 1547.5 $1547.5 - 1544 = 3.5$ FT

$Q = (3.10)\,55\,(3.5)^{3/2} = 1116$ cfs

$q = 55 \times 3.5 = 192.5$ $\quad r = \frac{192.5}{62} = 3.1$ $\quad n = .03$

$V = \frac{Q}{A} = \frac{1116}{192.5} = 5.8$ fps

$V = \frac{1.486}{.03}(3.1)^{2/3}(S)^{1/2}$

$S = \left(\frac{(5.8)(.03)}{1.486\,(3.1)^{2/3}}\right)^2 = .0033$ $\quad H_L = SL = .0033\,(168) = .36$ ft friction

$Q = 3.1 \times 55 \times (1547.5 - .36 - 1542.72)^{3/2} = 1584$ cfs

SAY 1600 cfs ←

AT ELEVATION 1546.5 $H = 2.5$ ft

$Q = 3.1 \times 55 \times (2.5)^{3/2} = 674$ cfs say 700

$q = 55 \times 2.5 = 137.5$ $\quad r = \frac{137.5}{60} = 2.29$

$V = \frac{Q}{A} = \frac{674}{137.5} = 4.9$ fps

$H_L = 118 \times \left(\frac{4.9 \times .03}{1.486 \times (2.29)^{2/3}}\right)^2 = .38$

$Q = 3.1 \times 55 \times (1546.5 - .38 - 1542.72)^{3/2} = 1069$ cfs

$Q = 1070$ cfs ←

SPILLWAY RATING (CONT.)

ELEVATION 1545.5 $H = 1.5$ ft.

$Q = 3.1 \times 55 \times (1.5)^{3/2} = 313$ cfs

$a = 55 \times 1.5 = 82.5$ $\quad r = \frac{82.5}{58} = 1.42$

$V = \frac{Q}{A} = \frac{313}{82.5} = 3.79$ fps

$H_L = 118 \times \left(\frac{3.79 \times .03}{1.486 \times 1.42^{2/3}}\right)^2 = .43$ ft

$Q = 3.1 \times 55 \times (1545.5 - .43 - 1542.72)^{3/2} = 615$ cfs ←

ELEVATION 1544.5 $H = .5$ ft

$Q = 3.1 \times 55 \times .5^{1.5} = 60.3$ cfs $\quad a = 55 \times .5 = 27.5$ ft

$V = \frac{60.3}{27.5} = 2.19$ fps $\quad r = \frac{27.5}{56} = .49$

$H_L = 118 \times \left(\frac{2.19 \times .03}{1486\ (.49)^{2/3}}\right)^2 = .6$ ft

$Q = 3.1 \times 55 \times (1544.5 - .6 - 1542.72) = 218$ cfs

Say $Q = 220$ cfs ←

BY VJK DATE 1/10/11 | BERGER ASSOCIATES | SHEET NO. 6 OF
CHKD. BY [illegible] DATE 2/2/11 | PROJECT D9490
SUBJECT MUD RUN DAM

SPILLWAY RATING (CONT.)

ELEVATION 1551.5 $H = 7.5$

$$Q = 3.1 \times 55 \times (7.5)^{1.5} = 3500$$

$$a = 55 \times 7.5 = 412.5 \qquad r = \frac{412.5}{70} = 5.89$$

$$V = \frac{3500}{412.5} = 8.48 \text{ fps}$$

$$H_L = 118 \times \left(\frac{8.48 \times .03}{1.486 (5.89)^{2/3}} \right)^2 = .33 \text{ ft}$$

$$Q = 3.10 \times 55 \times (1551.5 - .33 - 1542.72)^{1.5} = 4188$$

SAY 4200 cfs ←

TOP OF DAM RATING

ELEVATION 1548.6 $\bar{H} = .1$ FT $C = 2.7$ $L = 358$ ft

$$Q = 2.7 \times 358 (.1)^{1.5} = 31 \text{ cfs} \leftarrow$$

ELEVATION 1548.9

$$Q_1 = 2.7 \times 130 \times (.15)^{1.5} = 20.4$$

$$Q_2 = 2.7 \times 358 \times (.4)^{1.5} = 244.5$$

$$Q_3 = 2.7 \times 1275 \times (.15)^{1.5} = 20,$$

$$Q_4 = 2.7 \times 100 \times (.15)^{1.5} = 15.7$$

$$Q = 300 \text{ cfs} \leftarrow$$

BY DJR DATE 11/10/78 BERGER ASSOCIATES SHEET NO. 7 OF
CHKD. BY DAG DATE 11/22/78 PROJECT D8490
SUBJECT MUD RUN DAM

TOP OF DAM RATING (CONT.)

AT ELEVATION 1549

$Q_1 = 2.7 \times 17 \times (.05)^{3/2} = .5$

$Q_2 = 2.7 \times 130 \times (.25)^{3/2} = 43.9$

$Q_3 = 2.7 \times 358 \times (.5)^{3/2} = 341.7$

$Q_4 = 2.7 \times 170 \times (.25)^{3/2} = 57.4$

~~$Q_5 = 2.7 \times 42.5 \times (.05)^{3/2} = 1.3$~~

$Q_6 = 2.7 \times 32 \times (.05)^{3/2} = 1$

$Q_7 = 2.7 \times 100 \times (.25)^{3/2} = 33.8$

$Q = 480$ cfs ←

ELEV. 1549.7

$Q_1 = 2.7 \times 139 \times (.4)^{3/2} = 95$

$Q_2 = 2.7 \times 130 \times (.95)^{3/2} = 325$

$Q_3 = 2.7 \times 358 \times (1.2)^{3/2} = 1271$

$Q_4 = 2.7 \times 170 \times (.9)^{3/2} = 392$

$Q_5 = 2.7 \times 244 \times (.7)^{3/2} = 386$

$Q_6 = 2.7 \times 164 \times (.85)^{3/2} = 347$

$Q = 2815$ cfs ←

BY DJK DATE 11/10/77 BERGER ASSOCIATES SHEET NO. 8 OF 12
CHKD. BY [illegible] DATE 2/22/79 PROJECT D8490
SUBJECT MUD RUN DAM

TOP OF DAM RATING (CONT.)

AT ELEVATION 1551.5

$Q_1 = 2.7 \times 139 \times (2.2)^{3/2} = 1225$

$Q_2 = 2.7 \times 130 \times (2.75)^{3/2} = 1600$

$Q_3 = 2.7 \times 358 \times (3)^{3/2} = 5023$

$Q_4 = 2.7 \times 170 \times (2.7)^{3/2} = 2036$

$Q_5 = 2.7 \times 244 \times (2.7)^{3/2} = 2923$

$Q_6 = 2.7 \times 164 \times (2.65)^{3/2} = 1910$

$Q = 14,717$ cfs ←

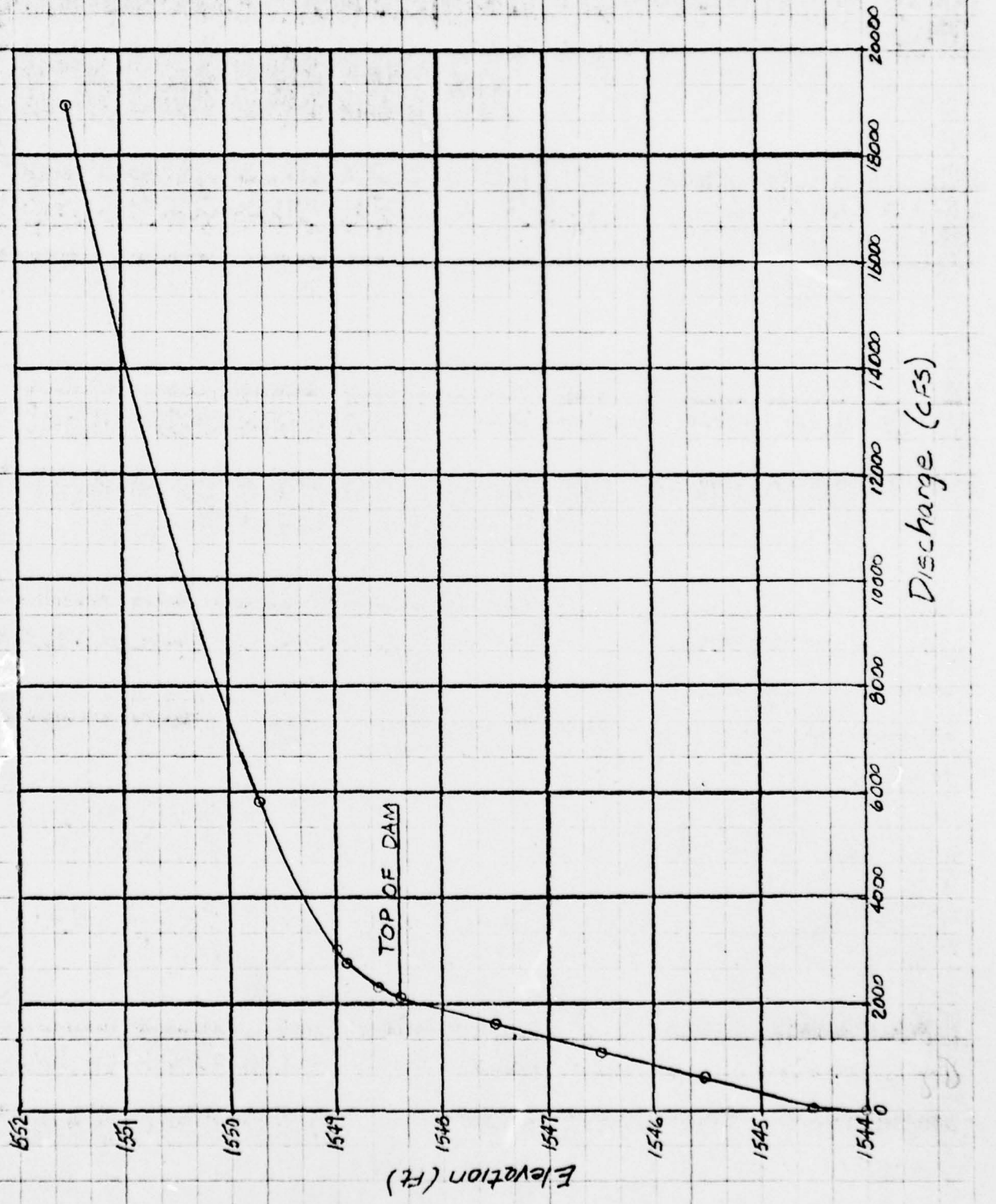
BY DJN DATE 1/10/19 **BERGER ASSOCIATES** SHEET NO. 9 OF 1
CHKD. BY RL DATE 2021 PROJECT 62490
SUBJECT MUD RUN DAM

TOP OF DAM RATING CURVE FOR HEC 1 :

	STAGE	DISCHARGE
	1544.0	0
	1544.5	220
	1545.5	615
	1546.5	1069
	1547.5	1600
(LOW PT. OF DAM)	1548.4	2100
	1548.6	2281
	1548.9	2740
	1549.0	2980
	1549.7	5765
	1551.5	18900

BY DJR DATE 11/7/79 **BERGER ASSOCIATES** SHEET NO. 10 OF 13
CHKD. BY DATE PROJECT D8490
SUBJECT MUD RUN DAM RATING

DISCHARGE RATING CURVE



BY DJR DATE 11/11/79 BERGER ASSOCIATES SHEET NO. 11 OF 12
CHKD. BY [illegible] DATE [illegible] PROJECT D8490
SUBJECT MUD RUN DAM

SIZE CLASSIFICATION:

Maximum Storage = 852 ACRE-FT
Maximum Height = 33 FEET
Size Classification is "SMALL"

HAZARD CLASSIFICATION:

Mud run joins Mill Creek about 2 miles downstream of the dam. Mill Creek passes through the town of St. Clair about 2 miles downstream of the confluence. USE "HIGH"

RECOMENDED SPILLWAY DESIGN FLOOD

The above classifications indicate use of an SDF from 1/2 The Probable Maximum Flood to the full PMF.

BY DJR DATE 1/19/79 | BERGER ASSOCIATES | SHEET NO. 12 OF 13
CHKD. BY KG DATE 2/21/79 | PROJECT DB490
SUBJECT MUD RUN DAM

HEC-1 DATA:

Drainage Area = .73 SQ.MI.

Delaware Basin Region 6

$C_p = .40$

$C_T = 1.35$

Longest water course $L = 1.19$ mi.

Length to centroid $L_{CA} = .675$

Time to peak:

$$T_p = C_T (L \times L_{CA})^{.3}$$

$T_p = 1.24$ HRS

Rainfall (HMR-33)

index = 22.9"

Incremental rainfall:

6 hr = 113%

12 hr = 123%

24 hr = 132%

48 hr = 143%

PLANIMETERED AREAS (QUAD SHEETS)

ELEVATION: 1544 = 48 ACRES

1560 = 82.64 ACRES

ZERO STORAGE ELEVATION = 1544 - (VOLUME × 3/AREA)

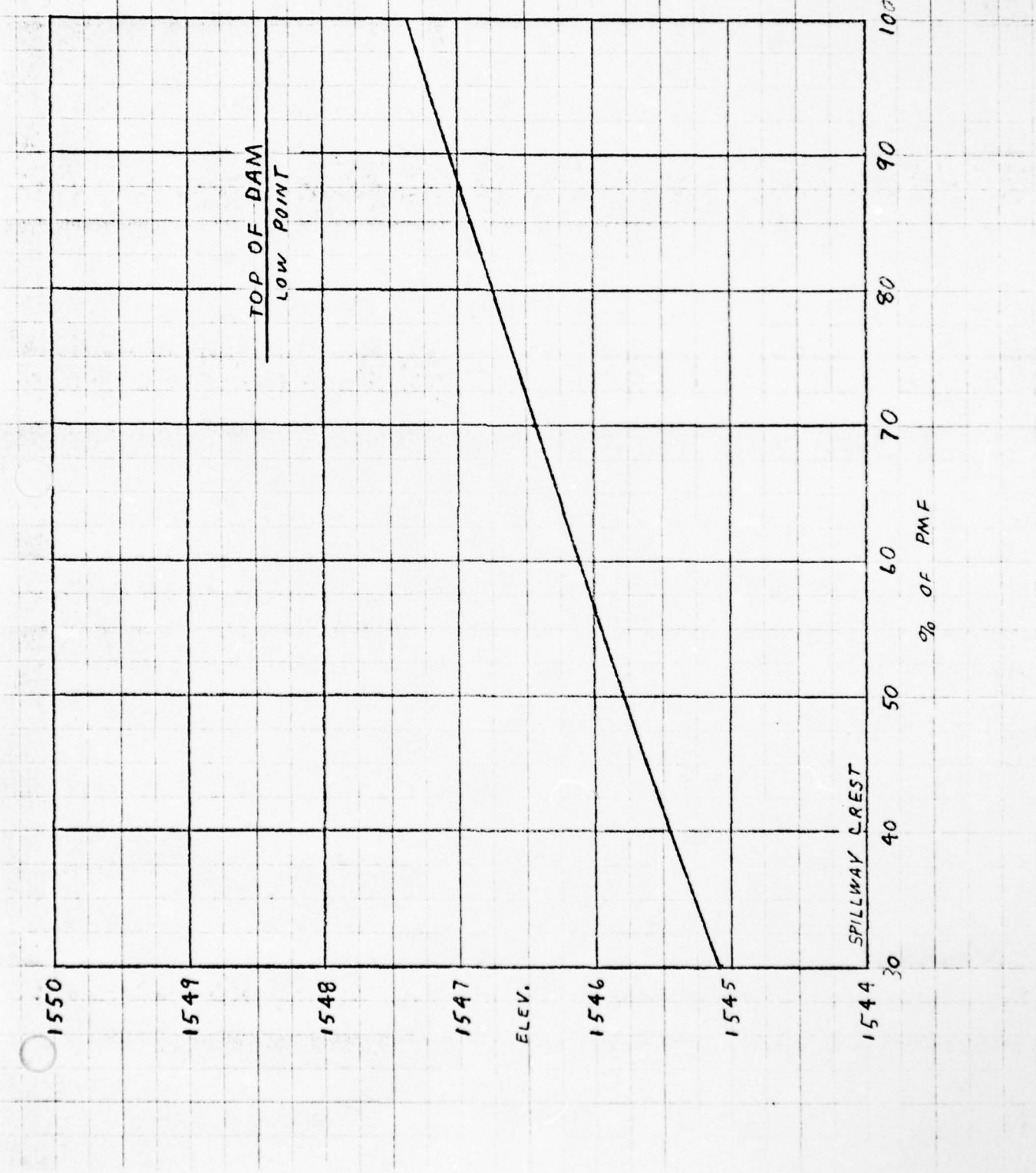
= 1505.1

BY RLS DATE 2/29/79 **BERGER ASSOCIATES** SHEET NO. 13 OF 13

CHKD. BY DATE PROJECT D8490

SUBJECT MUD RUN DAM

SPILLWAY CAPACITY CURVE



OVERTOPPING ANALYSIS 1/4

```
1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
 LAST MODIFICATION 21 AUG 78
**********
  1          A1    MUD RUN DAM ****  MUD RUN
  2          A2    NEWCASTLE TWP., SCHUYLKILL COUNTY
  3          A3    NDI # PA-00690   PA DER # 54-27
  4          B   300     0     15     0     0     0     0     0    -4     0
  5          B1    5
  6          J     1     9     1
  7          J1    1   .85    .7    .6    .5    .4    .3    .2    .1
  8          K               1                             1
  9          K1              INFLOW HYDROGRAPH
 10          M     1     1   .73
 11          P           22.9   113   123   132   143
 12          T                                             1   .05
 13          W  1.24    .4
 14          X  -1.5  -.05     2
 15          K     1     2                                 1
 16          K1              RESERVOIR ROUTING
 17          Y                             1     0
 18          Y1    1                                     622    -1
 19          Y4 1544 1544.5 1545.5 1546.5 1547.5 1548.4 1548.6 1548.9  1549 1549.7
 20          Y41551.5
 21          Y5    0   220   615  1069  1600  2100  2281  2740  2980  5765
 22          Y5 18900
 23          $A    0    48 82.64
 24          $E1505.1  1544  1560
 25          $$ 1544
 26          $D1548.4
 27          K    99

  1                  PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                          RUNOFF HYDROGRAPH AT        1
                          ROUTE HYDROGRAPH TO         2
                          END OF NETWORK

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
 LAST MODIFICATION 21 AUG 78
**********

RUN  DATE# 79/01/10.
     TIME# 15.36.01.

                          MUD RUN DAM ****  MUD RUN
                          NEWCASTLE TWP., SCHUYLKILL COUNTY
                          NDI # PA-00690   PA DER # 54-27

                                    JOB SPECIFICATION
          NQ    NHR   NMIN   IDAY   IHR   IMIN  METRC  IPLT  IPRT  NSTAN
         300     0     15     0     0     0     0     0    -4     0
                JOPER   NWT  LROPT  TRACE
                    5     0     0     0
```

NEWCASTLE TWP., SCHUYLKILL COUNTY
NDI # PA-00690 PA DER # 54-27

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1
RTIOS= 1.00 .85 .70 .60 .50 .40 .30 .20 .10

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.73	0.00	.73	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.90	113.00	123.00	132.00	143.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.24 CP= .40 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 52 END-OF-PERIOD ORDINATES, LAG= 1.25 HOURS, CP= .40 VOL= 1.00

11.	43.	85.	125.	149.	150.	135.	122.	109.	98.
88.	79.	71.	63.	57.	51.	46.	41.	37.	33.
30.	27.	24.	21.	19.	17.	16.	14.	13.	11.
10.	9.	8.	7.	7.	6.	5.	5.	4.	4.
3.	3.	3.	2.	2.	2.	2.	2.	1.	1.
1.	1.								

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.20	23.79	2.41	45242.
										(665.)(604.)(61.)(1281.11)			

********** ********** ********** ********** **********

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	622.	-1

STAGE	1544.0	1544.5	1545.5	1546.5	1547.5	1548.4	1548.6	1548.9	1549.0	1549.7
	1551.5									
FLOW	0.	220.	615.	1069.	1600.	2100.	2281.	2740.	2980.	5765.
	18900.									
SURFACE AREA=	0.	48.	83.							
CAPACITY=	0.	622.	1655.							
ELEVATION=	1505.	1544.	1560.							

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1544.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1548.4	0.0	0.0	0.

PEAK OUTFLOW IS 1523. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 1288. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 1047. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 897. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 744. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 590. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 444. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 299. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 152. AT TIME 42.50 HOURS

********** ********** ********** ********** **********

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO
				1.00	.85	.70	.60	.50	.40	.30	.20	.1
HYDROGRAPH AT	1	.73	1	1843.	1566.	1290.	1106.	921.	737.	553.	369.	184.
		(1.89)	(	52.19)(	44.36)(	36.53)(	31.31)(	26.09)(	20.87)(	15.66)(	10.44)(	5.22)
ROUTED TO	2	.73	1	1523.	1288.	1047.	897.	744.	590.	444.	299.	152.
		(1.89)	(	43.13)(	36.48)(	29.66)(	25.39)(	21.07)(	16.69)(	12.58)(	8.46)(	4.29)

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1543.98	1544.00	1548.40
STORAGE	621.	622.	852.
OUTFLOW	0.	0.	2100.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1547.36.	0.00	794.	1523.	0.00	42.50	0.00
.85	1546.91	0.00	770.	1288.	0.00	42.50	0.00
.70	1546.45	0.00	746.	1047.	0.00	42.50	0.00
.60	1546.12	0.00	728.	897.	0.00	42.50	0.00
.50	1545.78	0.00	711.	744.	0.00	42.50	0.00
.40	1545.44	0.00	693.	590.	0.00	42.50	0.00
.30	1545.07	0.00	675.	444.	0.00	42.50	0.00
.20	1544.70	0.00	656.	299.	0.00	42.50	0.00
.10	1544.34	0.00	639.	152.	0.00	42.50	0.00

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 21 AUG 78
****
EOI ENCOUNTERED.
N>BYE

JOB PROCESSING CCUS 2.535
BYE 79/01/11. 04.46.08.

0

APPENDIX D

GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Names: Pottsville Formation, Sharp Mountain Member; Llewellyn Formation.

Lithologies: The Llewellyn Formation, which underlies most of the dam and reservoir, consists of gray to brown quartz sandstone to impure sandstone and siltstone with lesser amounts of conglomerate, and shale. Most of the mineable beds of the Anthracite Coal Fields are in the Llewellyn Formation. The basal contact of the Llewellyn Formation with the underlying Sharp Mountain member of the Pottsville Formation is marked by the Buck Mountain Coal bed. The Sharp Mountain Member consists of coarse conglomeratic sandstone. The Buck Mountain coal bed apparently, is not of mineable thickness under the dam and reservoir.

Structure

The axis of the New Boston Syncline which trends about N85°E passes under the dam and reservoir. This syncline is doubly plunging so that the dam is essentially located near the center of a elongate basin. The Frackville Fault, a high angle reverse fault which offsets the north limb of the New Boston Syncline also passes under the dam. This fault also strikes N85°E and dips 45° to 50°S. The beds of the north limb of the syncline are also offset by a series of N10°E to N20°E trending crossfaults. These faults are probably vertical. One is mapped passing under the dam. Air photo fracture traces trend N50° to 60°W.

Overburden

This dam was built in 1879 and no core borings are available. The dam was rebuilt in 1903 and a concrete cutoff wall was apparently added. A report written in 1914 states that the embankment rests on "a layer of clay six feet thick beneath which is layer of sand and gravel five feet thick". The core wall is reported to pass through the clay and the sand and gravel into another layer of clay.

Aquifer Characteristics

The Llewellyn Formation is composed of rocks which are essentially impermeable and all ground water movement is along bedding planes and fractures. Secondary porosity and permeability has been created in much of the area by mining of the coal beds and caving in of the mine roof. There is no information concerning mining at the dam site, but there apparently has been no mining under the dam.

Discussion

As originally constructed this dam leaked badly. The reconstruction in 1903, when the cutoff wall was added, apparently corrected the worst of the problems. It is surprising that there is no leakage through the bedrock since the bedding planes and at least one fault intersect the dam axis at a high angle. Perhaps the clay layer mentioned effectively isolates the reservoir from the bedrock. It should be noted, however, that there is no evidence that this dam is founded on sound bedrock.

The many faults mapped in the area formed at the time of folding more than 270 million years ago, and are not known to have been active since that time.

Sources of Information

1. Wood, G.H. and Arndt, H.H. (1969), "Geologic map of the Shenandoah Quadrangle, Schuylkill County, Pa." U.S.G.S. Map GQ 781.

2. Air Photos, dated 1969, scale 1:24,000.

3. Inspection reports in file.

GEOLOGIC MAP - Mud Run Reservoir Dam

(geology from U.S.G.S. Map GQ-781)

Pl	Llewellyn Fm.
Pps	Pottsville Fm.- Sharp Mountain Member
Ppc	Pottsville Fm.- Schuylkill Member
Ppt	Pottsville Fm.- Tumbling Run Member
PMmu	Mauch Chunk Fm.- upper member
— — —	fault
— —bm—	Buck Mountain Coal bed
—·—·—	air photo fracture trace

SCALE 1:24000

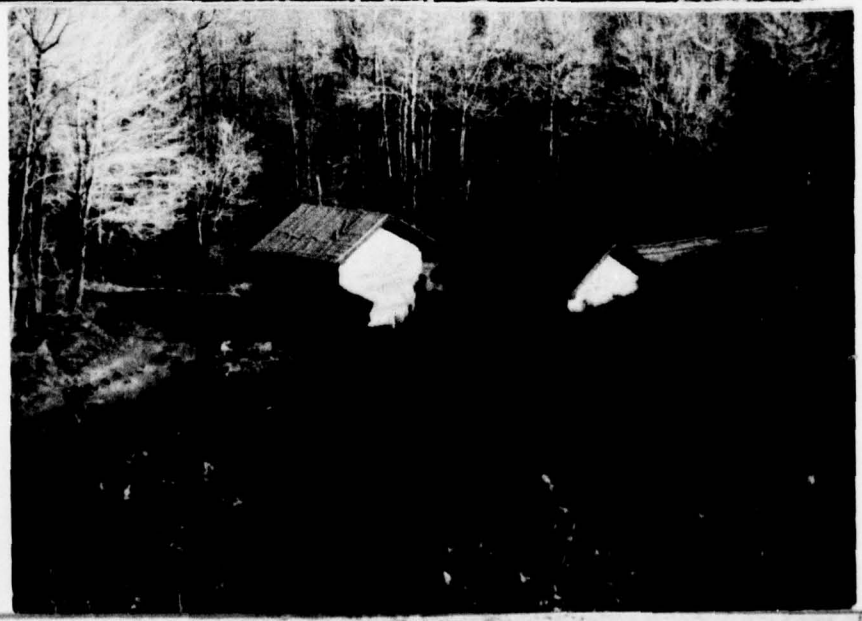
1 0 1 MILE

APPENDIX E

PHOTOGRAPHS

Upstream
Embankment Slope

Downstream
Embankment Slope



Valve Houses

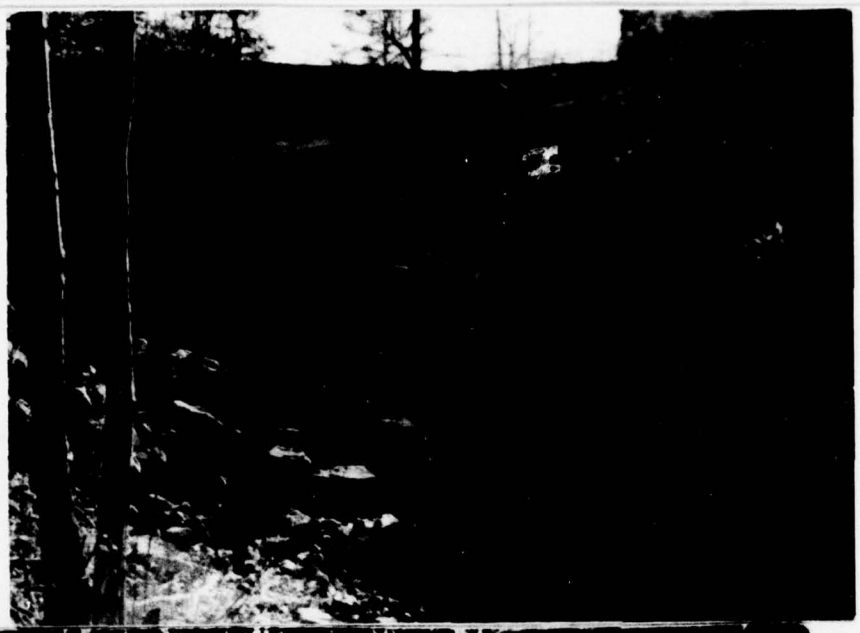
PA-690
PLATE E-I

Exposed Pipe
Between Valve
Houses

Spillway
Approach Channel

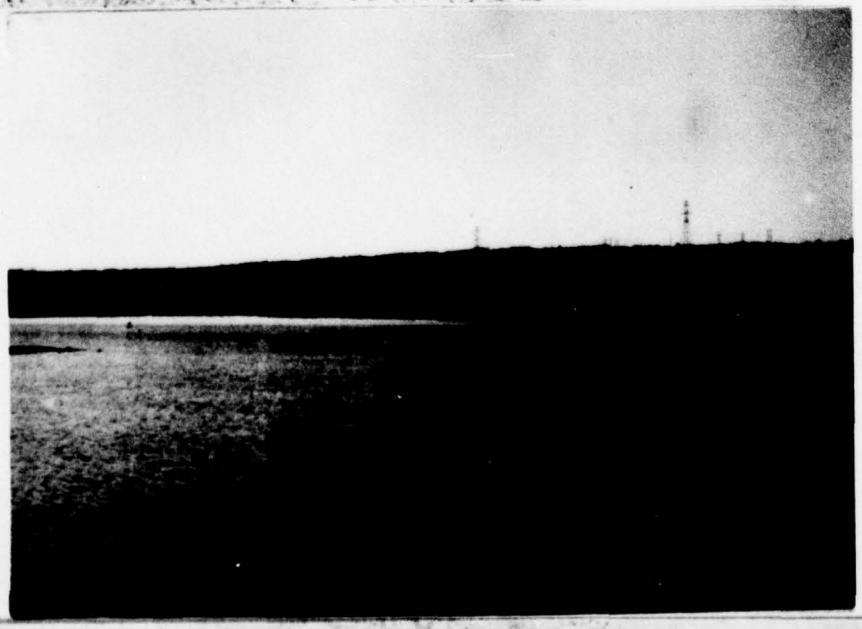
Spillway Crest

PA-690
PLATE E-II



Downstream End
of
Spillway Apron

Spillway Outlet
Channel

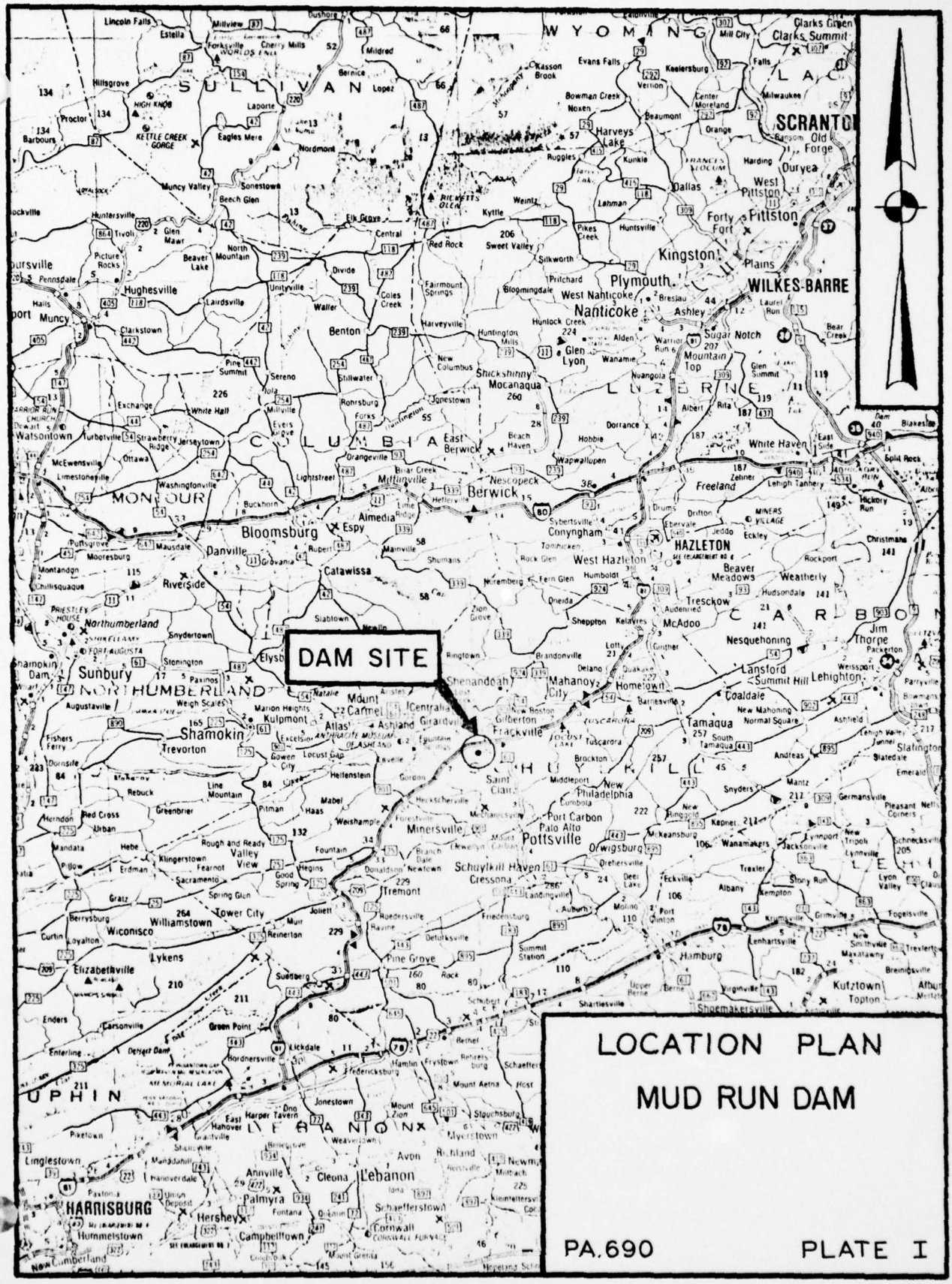


Reservoir Area

PA-690
PLATE E-III

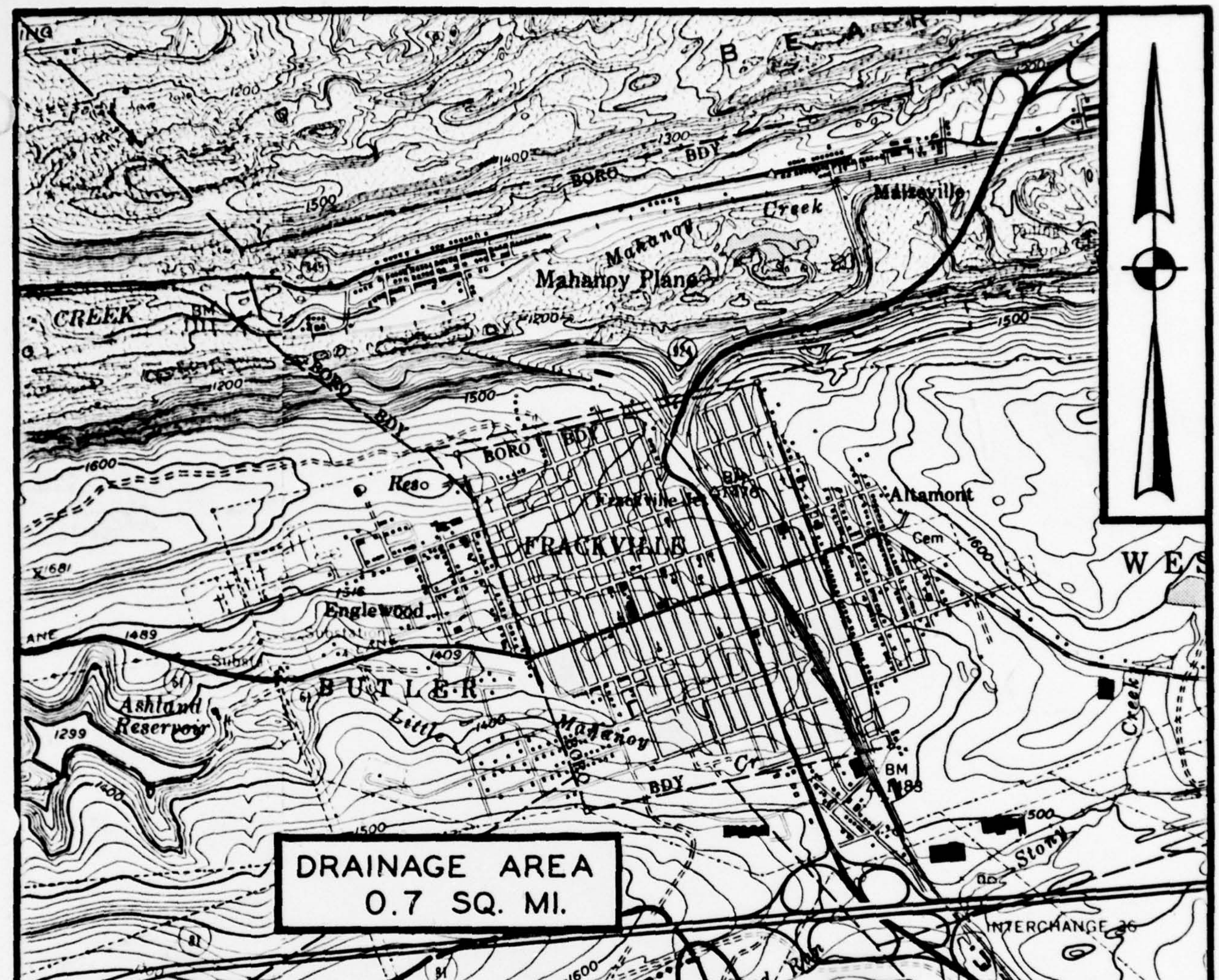
APPENDIX F

PLATES



LOCATION PLAN
MUD RUN DAM

PA.690 PLATE I



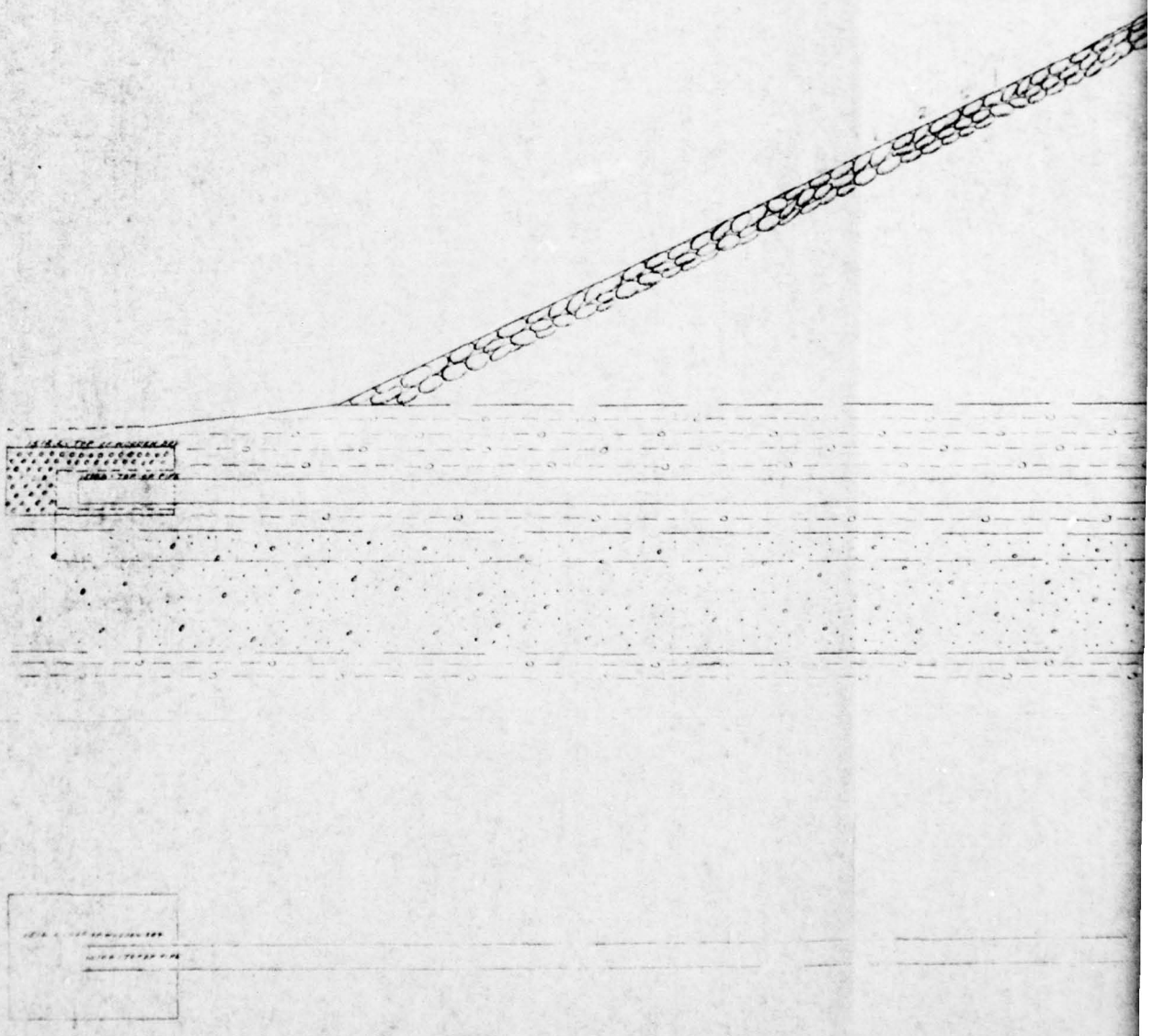
VICINITY MAP

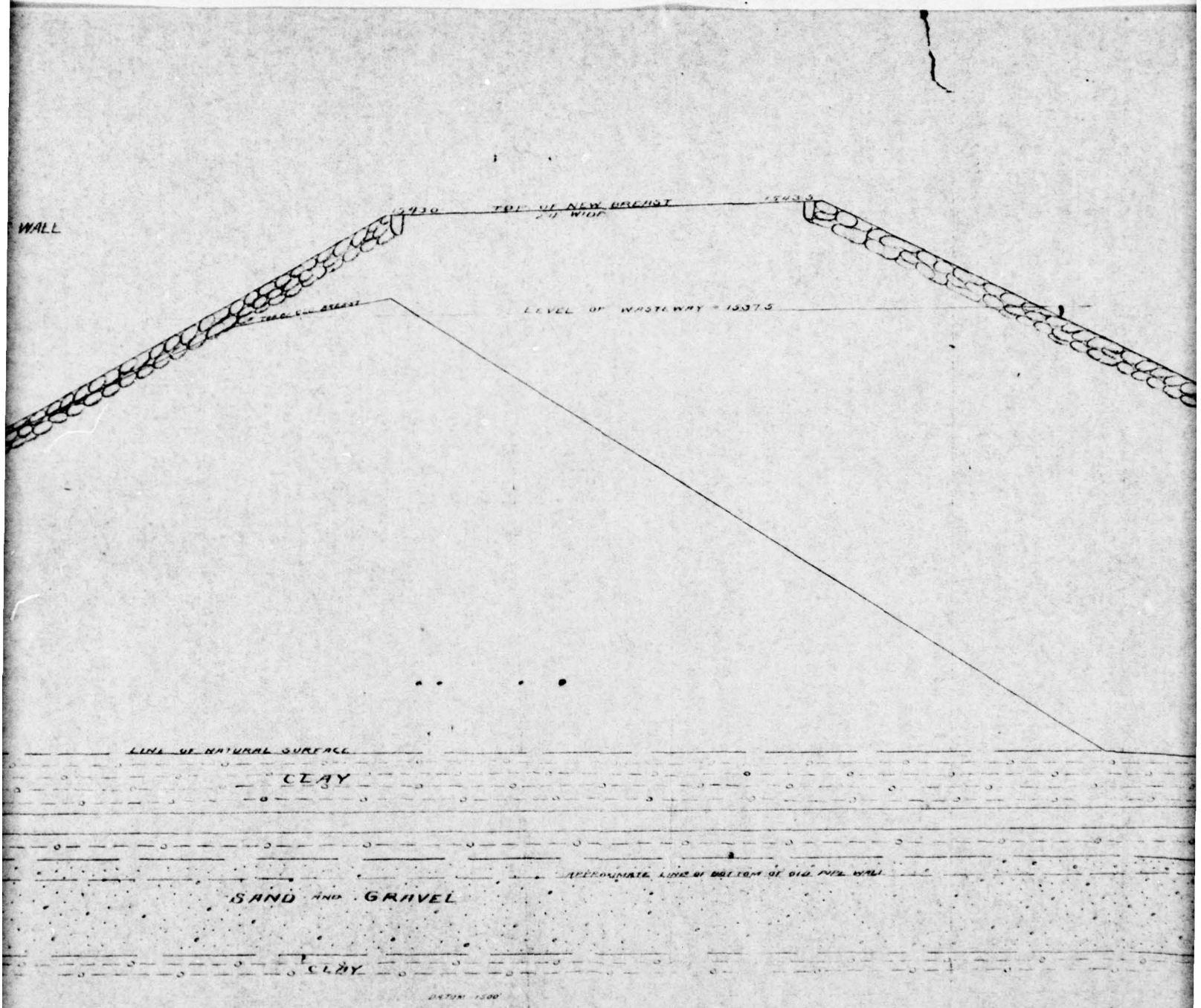
U.S.G.S. QUADRANGLE
SHENANDOAH, PA.
MUD RUN DAM

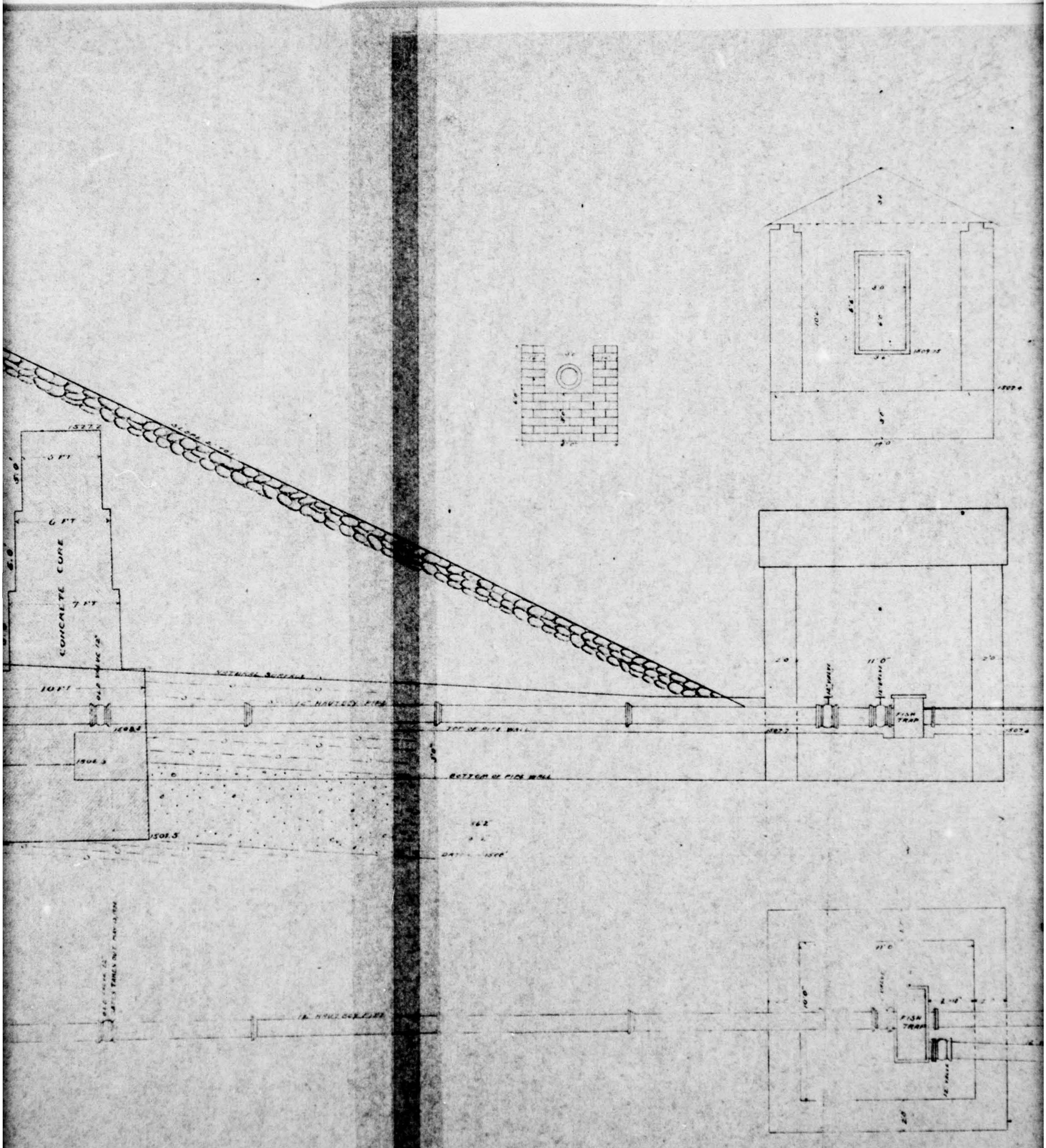
PA. 690 PLATE II

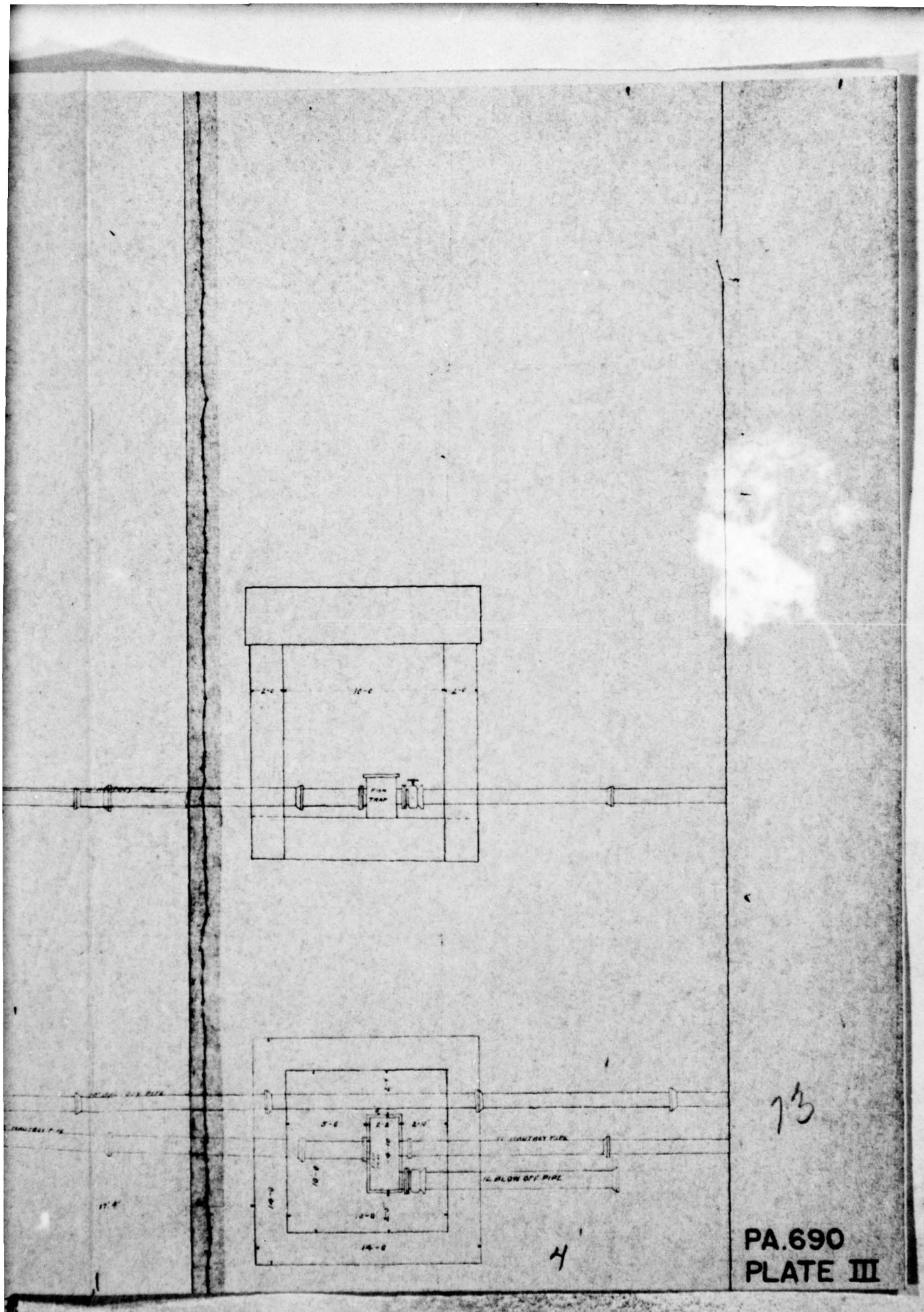
MUD RUN DAM

SECTION ON LINE OF SUPPLY PIPE THROUGH BREAST SHOWING PROPOSED NEW VALVE HOUSE AND P




WALL
15430
TOE OF NEW BREAST
20' WIDE
15435
LEVEL OF WASTEWAY = 15375
LINE OF NATURAL SURFACE
CLAY
APPROXIMATE LINE OF BOTTOM OF OLD PIPE WALL
SAND AND GRAVEL
CLAY
DATUM 1500


1527.2
5 FT
6 FT
7 FT
CONCRETE CORE
10 FT
NATURAL SURFACE
TOP OF PIPE WALL
BOTTOM OF PIPE WALL
1501.5
FISH TRAP
FISH TRAP



PA.690
PLATE III